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RECORDS OF REVISION

Rev.	Date	Description	POC	OIC
0	06/29/99	Document rewritten and reformatted to support LIR 220-03-01, Facility Engineering Manual. This chapter supersedes LANL Engineering Standards Drafting Manual, Vol. 2, Rev. 7, dated 4/17/98.	Danny Nguyen, *PM-2*	Dennis McLain, *FWO-FE*
1	10/29/01	Drawing size & format defined; added grid reference; title blocks modified for new numbering system; title sheets required, fonts, line widths, text height, line types explained; location plan pinpointed; north symbol generated & location defined; partial & key plans defined; graphic scales defined; drawing scales expanded.	Richard Trout, *FWO-SEM*	Mitch S. Harris, *FWO-SEM*
2	07/15/02	Minor Change. Editorial changes throughout as indicated by revision bars. Added Section 201 subsection 5.0 Grid System.	Richard Trout, *FWO-SEM*	Kurt Beckman, *FWO-SEM*
3	9/16/04	Revisions reflect change from LEM to ESM (Engineering Standards Manual). Moved “Line Width Assignment in Electronic Files to section 212.2.0. Changes/additions to sections 201.2, 202 Table Note (d), 201.4, 208.2, 209.6, 211.1A, and 215.1A. Miscellaneous editorial and Figure modifications throughout as indicated by revision bars.	Richard Trout, *FWO-DECS*	Gurinder Grewal, *FWO-DO*

PLEASE CONTACT THE RESPONSIBLE ENGINEERING STANDARDS POC AND COMMITTEE
for upkeep, interpretations, and variance issues

LDM	Drafting Manual POC

201 DRAWINGS

1.0 DRAWING SHEET SIZES AND FORMAT

A. Produce standard construction drawings and individually controlled drawings (priority drawings i.e., PFDs, P&IDs, electrical one-lines, etc.) on a "D" size sheet. (**Note:** LANL has chosen "D" size sheets for ease in reproduction media machinery available and "B" size reproduction use by maintenance and system engineers.)

1. Exception: New facilities with a base floor plan of 50,000 sq. ft. or larger may use "E" size with approval of the Drafting Standards POC prior to design layout.

B. Produce Engineering Studies, Conceptual Design Reports, and Design Criteria drawings on a "B" size sheet whenever possible.

C. Use a consistent size of drawing sheet throughout the Drawing Set.

Note: Exception applies to vendor drawings that are attached at the end of the drawing package.

D. Provide a continuous line sheet border, as illustrated below that is 0.75 mm thick (1 /16 inch).

E. Standard drawing sheet sizes, borders, and formats are shown below. The overall dimensions are the sheet cut size. *(AutoCAD drawing files for standard LANL title blocks can be downloaded from the LANL Engineering Standards website: http://www.lanl.gov/f6stds/pubf6stds/New_Home.html)*

F. *Guidance: An "A" size sheet may be used for sketches for Design Change Packages (DCP), Engineering Change Notices (ECN), etc. The title block should contain the information as in Section 103.4.6 in a format as depicted in Section 202.*

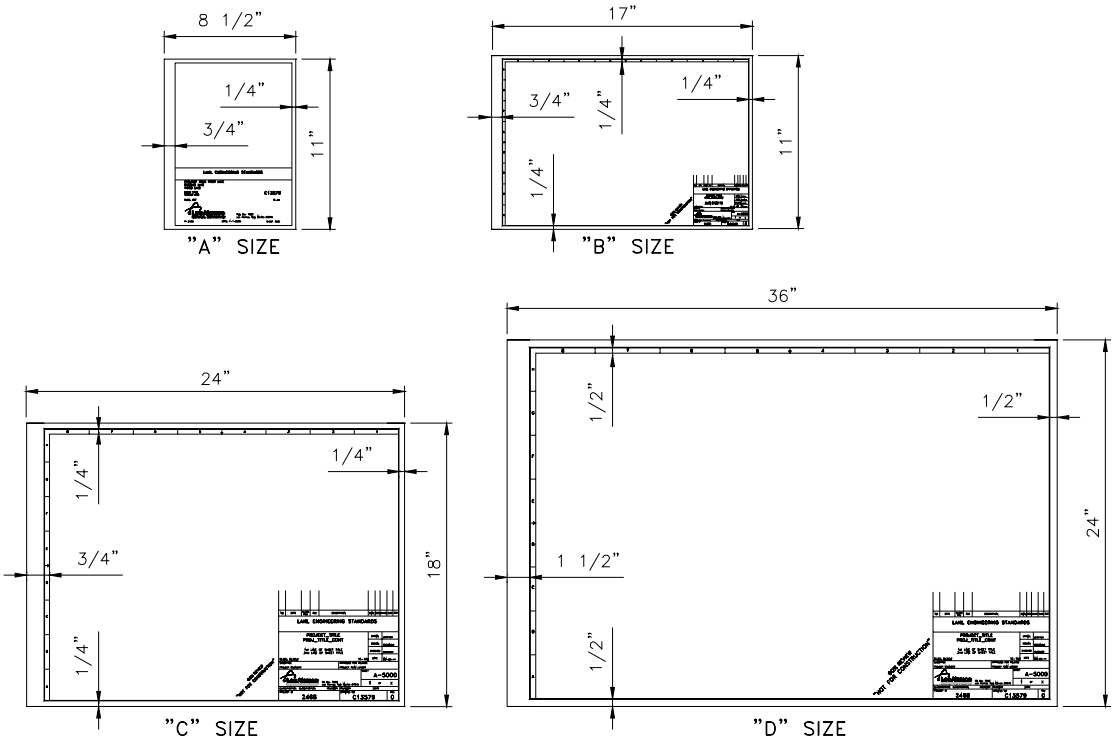


Figure 201-1

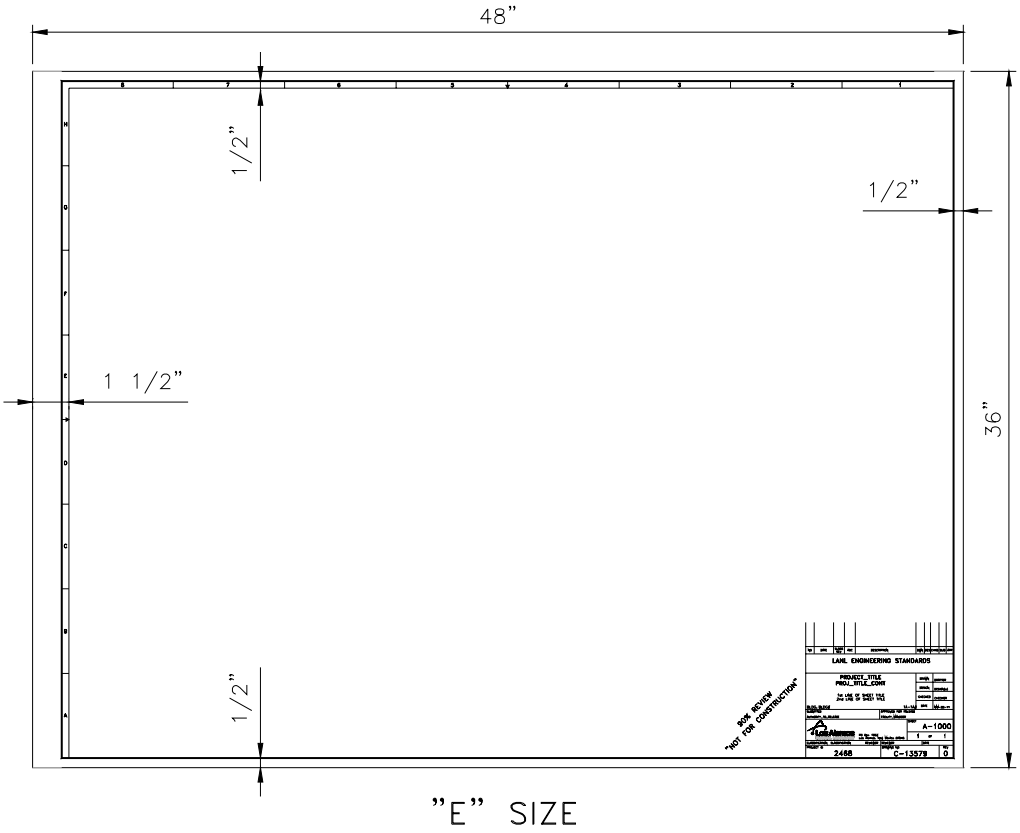


Figure 201-2

G. "C" and "E" size sheets may be used for special projects not related to 1.0 A and B of this section. LANL project manager shall give guidance for determining sheet usage. (No construction drawings on "E" sized sheets.)

2.0 FINAL DRAWING SUBMITTALS (INCLUDING AS-BUILTS)

A. All construction drawing design packages and supporting documentation (calculations, specifications, vendor drawings, shop drawings, submittals, T & B, etc.) generated by LANL personnel, contractors, and subcontractors shall be submitted to the FWO DCRM Team Central Records center.

B. Submit paper prints and electronic files as follows:

1. **Final, approved and stamped paper prints:** Full size, with all required signatures/initials signed off. Use black line on a minimum 0.003 inch paper thickness. Do not use stick-on, appliqués, zip-a-tone, etc. on final drawing sheets.
2. **Electronic files:** Refer to Section 215 for requirements.

C. Paper prints and electronic files are required for submittal for: final (stamped) design ready "For Construction" and final "As-Built" (after verification of accuracy).

3.0 "NOT FOR CONSTRUCTION" NOTATION

The note "NOT FOR CONSTRUCTION" is to be marked on all in-progress construction drawing sheets in a Construction Drawing Set. Print the review stage (%) above "Not for Construction" and do not remove this notation until the drawings are approved for final release. See symbol block in Appendix B, General.

Appearance	Font	Location
Letter size 1/4 inch	Romand	Left of the title block at a 45-degree angle, read from left to right

4.0 SEALED DRAWINGS

A. Comply with the LANL Engineering Standards Manual (ESM) Chapter 1, Z10 for the requirements of sealing construction documents.

B. The location of the Engineer's Stamp (seal) is to the "immediate left" of the title block just above the sheet border (if required).

C. Revisions to drawings may require an Engineers Stamp. The Engineers Stamp shall appear on the ECN or DCP documentation but not on the drawing or on sketches.

5.0 GRID SYSTEM [1]

A. Grid system is used to indicate structural columns, load-bearing walls, shear walls and other structural elements on the drawings.

B. Grid lines are used as a basis for dimensioning.

C. Vertical grid lines shall have designators at the top of the grid lines, numbered from left to right.

D. Horizontal grid lines shall have designators at the right side of the grid alphabetized from bottom to top.

E. To eliminate confusion with the numerals 0 (zero) and 1 (one), do not use letters “O” or “I.”

F. In some cases, grid designators may be shown at both ends of the grid line to facilitate references.

G. Where additional intermediate structural support elements occur between grid lines, a fractional designation is used (e.g., a column occurring at mid-point between grid lines 2 and 3 would be designated as 2.5, a column occurring between grid lines B and C would be represented as B.5.

H. Show grid lines on layer 5-grid, 0.35 mm (0.015 inches) pen width, pen color 7 (white), centerline line style and with 1/2 inch diameter circles for grid designators.

I. All disciplines shall use this convention for grid lines.

J. For existing conditions match existing grid line designators.

K. Terminate grid lines 1/8 inch from structure.

L. Designator text size shall be 3/16 inch Romans.

202 TITLE BLOCKS

1.0 GENERAL

A. Maintain consistency and accuracy in title block format and content throughout the Drawing Set.

[1] Basis: National CAD Standards.

B. The extent of the drawing field and an example of the title block are shown below. *This allows for the consistent placement of notes, general notes, security classification stamps, and key plans. The preferred extent of the drawing field is illustrated, for clarity purposes only, with the dashed line. See Section 205 for the location of key plan.*

1. Do not graphically show this border on the drawing.

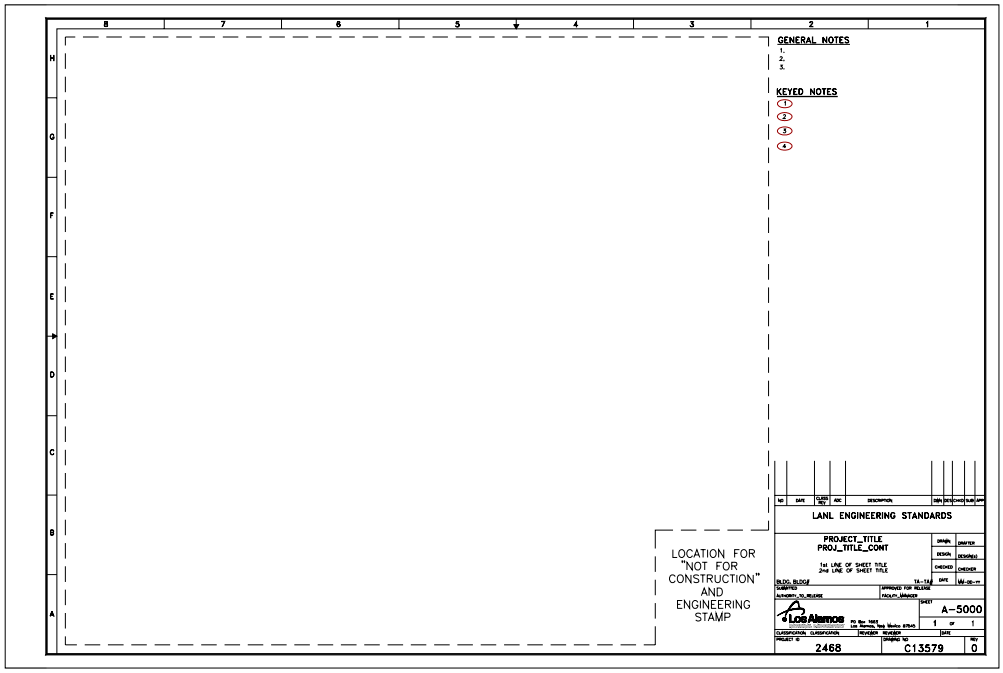


Figure 202-1

C. Only priority drawings (PFDs, P&IDs, Electrical one-lines, etc.) and General Notes/Legends sheets may encroach into the no-draw zone. Note location of General Notes and Keyed Notes.

2.0 TITLE BLOCK FOR CONSTRUCTION DRAWINGS

A. The standard Title Block for construction drawings is shown in Figure 202-2. See Table 202-1 for legend and description of the required Title Block contents.

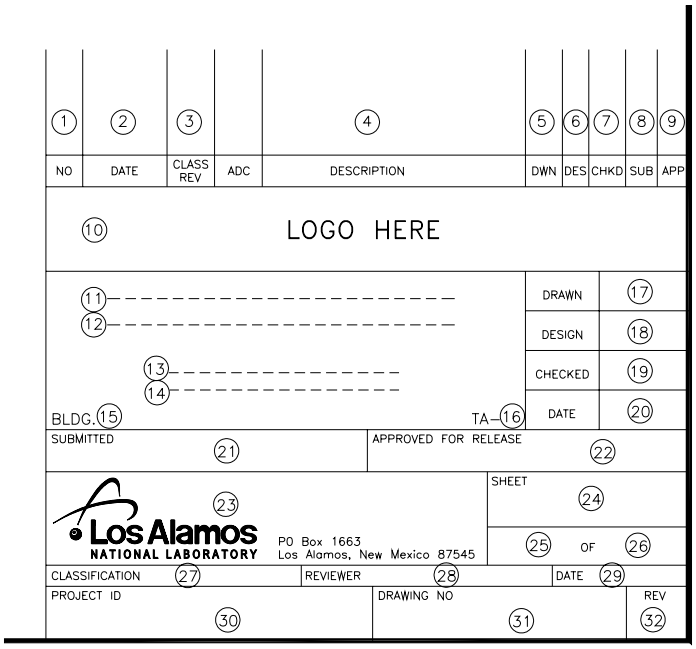


Figure 202-2

B. Figure 202-3 is an example of the Title Block for construction drawings.

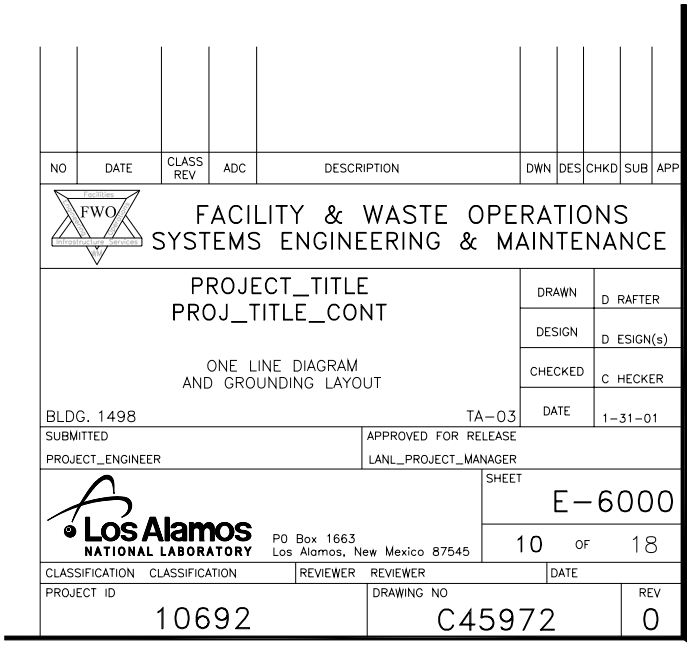


Figure 202-3

C. Standard LANL Title Blocks have been created on the World Wide Web site listed in Appendix H (http://www.lanl.gov/f6stds/pubf6stds/drftman/appendix.htm).

TABLE 202-1
Construction Drawing Title Block Contents

Item	Description	Character/ Size Font	Notes	Data Definition
1	Revision Number	3/32” romans		Number of revision made to the drawing.
2	Date of Revision	3/32” romans		Date the revision was made to the drawings.
3	Classification	3/32” romans	1, 4	The LANL ADC familiar with the project or area of construction will classify the revision and place his/her initials to the right of the classification in the revisions block (Item #3A) with an explanation for the reclassification.
3A	Authorized Derivative Classifier	3/32” romans		
4	Revision Description	3/32” romans		A description of the changes made to the drawing, P.I. number, A/B date, etc.
5	Drawn	3/32” romans	1	Initials and/or last name of the designer/drafter.
6	Design	3/32” romans	1	Initials and/or last name of the designer/engineer.
7	Checked	3/32” romans	1	Initials and/or last name of the checker.
8	Submitted	3/32” romans	3, 5	Initials of the person in the design agency with the authority to release the drawings
9	Approved for Release	3/32” romans	3, 5	Initials of the LANL Project Leader or Facility Manager with final approval for release.
10	Drawing Originating Organization			The logo/name of the organization or firm doing the design.
11	Project Title	3/16” romans	2	A project title will be filled in for: new facility construction, new addition to an existing facility, the installation of a new system in an existing facility, or Standards Manual Drawing. No title descriptions are required, for modifications or upgrades to existing facilities or systems.
12	Project Title Line 2	3/16” romand	2	
13	Sheet Title	1/8” romand	2	A descriptive title of the information contained on the drawing sheet. Typically, the type of drawing (e.g., Process and Instrumentation Diagram)
14	Sheet Title Line 2	1/8” romand	2	Space for continuation of the Sheet Title. Typically, the detail information (e.g., Compressed Air system)
15	Building Number	1/8” romans		The unique identifying number for a building or structure within a designated technical area.
16	Technical Area	1/8” romans		The geographical area designation assigned to LANL properties.

Continued on next page

TABLE 202-1
Construction Drawing Title Block Contents (con't)

Item	Description	Character/ Size Font	Notes	Data Definition
17	Drawn	3/32" romans	1	First initial and last name of the drafter/designer. (Not required for issuance after revision 0.)
18	Design	3/32" romans	1	First initial and last name of the designer/engineer. (Not required for issuance after revision 0.)
19	Checked	3/32" romans	1	First initial and last name of the person who checked the drawings, but not the same person who designed or produced the drawing. (Not required for issuance after revision 0.)
20	Date	3/32" romans	1	Date the final drawing set is issued. Date all sheets the same.
21	Submitted	3/32" romans	3, 5	Typed name and signature of the person at the design agency with the authority to release the documents.
22	Approved for Release	3/32" romans	3, 5	Typed name and signature of the LANL Project Team Leader or Facility Manager responsible for the project with the final approval for release.
23	Responsible Organization	LANL logo		Logo/name of the organization for whom the drawing is produced (LANL).
24	Discipline Sheet Number	1/4" Text height and 0.85 text width romand		Alphanumeric characters sequentially numbered, by discipline through the project drawing set. Also see Section 211.
25	Project Sheet Number	1/4" Text height and 0.85 text width romand		A sequential number assigned to each drawing sheet in a project drawing set.
26	Number of sheets in a project drawing set	1/4" Text height and 0.85 text width romand		Total number of drawings in the project drawing set.

Continued on next page

TABLE 202-1
Construction Drawing Title Block Contents (con't)

Item	Description	Character/ Size Font	Notes	Data Definition
27	Classification	3/32" romans	1, 4	The security classification of the drawing set uses a designation of: **"U"** for Unclassified; **"OUO"** for Official Use Only; **"C"** for Confidential; **"UCNI"** for Unclassified Controlled Nuclear Information; and, **"S"** for Secret. The LANL Authorized Derivative Classifier (ADC) can provide the classification requirements. For a drawing set that contains security information, each drawing shall be stamped with the classification with text of not less than 1/8". Example: Appendix B symbol G39 UCNI stamp. Locate the stamp to the left of the "Not for Construction/Engineer's Stamp"
28	Classifier/ Reviewer	3/32" romans	1, 4	The signature or initial and name of the person authorized to classify drawings.
29	Classification Date	3/32" romans	4	Date of classification signature.
30	Project Identification Number	1/4" romand	5	A unique number assigned to a task by the LANL Computerized Maintenance Management System (CMMS). This number is used for projects that generate paper documents and record drawings to be placed with FWO DCRM Team.

Continued on next page

TABLE 202-1
Construction Drawing Title Block Contents (con't)

Item	Description	Character/ Size Font	Notes	Data Definition
31	Drawing Number **"C"**	1/4" romand	#6	A unique number assigned to the drawing set by the FWO-IBS DCRM Team. It is an alphanumeric number with no spaces, dashes, or slashes; preceded by the capital letter "C." Used for record drawings associated with new facility and additions to existing facility construction.
	Drawing Number **"PL"**	1/4" romand	#6	A unique number assigned to the plate(s) (PL) set by the FWO DCRM Team. It is an alphanumeric number with no spaces, dashes, or slashes; preceded by the capital letters "PL."
	Drawing Number **"SK"**	1/4" romand	#6	A unique number assigned to the sketch (SK) by the FWO DCRM Team. It is an alphanumeric number with no spaces, dashes, or slashes; preceded by the capital letters "SK."
	Drawing Number **"ST"**	1/4" romand	#6	A unique number assigned to the standard drawing (ST) by the FWO DCRM Team. It is an alphanumeric number with no spaces, dashes, or slashes; preceded by the capital letters "ST."
32	Revision Number	1/4" romand		Number of revisions made to the drawing.

Notes:

1. Enter appropriate names and dates electronically. When issuing drawings for design review, initials or signatures are required for the checked, submitted, and classification blocks. For the final issue, initials or signatures are required above or alongside all printed names.
2. Do not underline titles or subtitles.
3. The title block contents 8, 9, 21 & 22 require approvals. The number and headings of approval signatures/initials shall be determined by the LANL Project Leader.
4. a. This section of the title block must be filled in when the record document package is signed off for approval.
   b. Follow LANL's S-7 Group requirements for review/signature.
   c. *Guidance: Use an Authorized Derivative Classifier (ADC) associated and/or familiar with the project. The ADC should be contacted and informed about the project during the early stages of design development.*

d. ADC in classification shall appear in title block on all technical design review drawing package submittals.[2]

e. Drawings placed on MOADS (database) by FWO-IBS DCRM must be unclassified.

5. The following is a guide to assist the design agency to determine P.I.# and C# requirements:

6. See Attachment 1 for Contact Information.

Project Configuration		
	Type of Design Work	**Package Requirements**
New Project *(not Design Build)*	a) single TA and single Bldg.	1 (one) PI# and 1 C#
	b) single TA and multiple Bldgs. Note: Use <u>one</u> Title Sheet and separate facilities into individual facility sets within the drawing package.	1 PI#-and separate C#'s for each facility.
	c) multiple TAs and multiple Bldgs. Note: Organize final submittal as follows: Lowest TA# first with individual facility subsets in numerical order, followed by next TA# and facility sequence.	1 PI# and separate C#'s for each facility.
	d) LANL-Wide Project (i.e., road or utility projects)	1 PI# and 1 C#.
New Project *(Design Build)*	a) single TA and single Bldg. submitted in separate design phase packages. Note: When project is submitted to FWO-DCRM Records Center, consolidate a list of drawings on the first (1st) Title Sheet, void all other title sheets and renumber the drawing sheets sequentially, reflecting the modification in each title block (items #25 & #26) and the 1st Title Sheet.	1 PI# and 1 C# **with** each design phase package labeled 1, 2, 3, 4, etc.

[2] Basis: DOE Order 475.1-1, Identifying Classified Information, which is part of the WSS, states in Chapter VI that:
"Review Requirements." Anyone who originates a document or material in a subject area that may be classified shall submit the document or material to the appropriate official for a classification review and determination prior to dissemination.
a.) Routine Document or Material. An employee with an active access authorization who originates a document or material in a subject area that may be classified shall submit the document or material to a Derivative Classifier for classification review prior to dissemination. An employee who had an active access authorization in the past shall submit such a document or material to the local Classification Officer for classification review prior to dissemination. The local Classification Officer may delegate this review responsibility to specified Derivative Classifiers."

	Type of Design Work	Package Requirements
Existing Facility *(existing system modification)*	a) Locate all existing drawings pertinent to the project and follow the drawing revision procedure per Section 103 of this manual as well as AP-ENG-002 and/or AP-ENG-003. b) If new drawing sheets are to be generated, follow this manual for new drawing requirements. c) New sheets generated to accompany a drawing package primarily composed of **existing drawings that have been revised:** *d)* New drawings generated for a drawing package comprised of revised drawings from e**xisting multiple packages with several PI# and C#s:**	Will have the same PI # as the revised sheets BUT a new C#. The new drawings will have New PI#s and New C#s – with references in the General Notes to the existing drawings.
Existing Facility (New System and/or new addition)	a) Follow 5 a) **New Project**	

5. *Guidance: additional "submittal" or "approved" blocks may be added to suit project sign-off requirements.*

3.0 TITLE BLOCK AND DRAWING FORMATS FOR ENGINEERING STUDIES (ES), DESIGN CRITERIA (DC), AND CONCEPTUAL DESIGN REPORTS (CDR)

A. The drawings produced for Engineering Studies (ES), Design Criteria (DC) and Conceptual Design Reports (CDR) are not intended for use as construction documents; therefore, stamps and signatures are not required. The FWO DCRM Team will enter title block information into its master database when record copy is received.

B. Provide accurate and consistent information in the title block throughout the drawing set.

C. Produce Engineering Studies, Design Criteria and Conceptual Design Report drawings on "D" size sheets and submit on 11" X 17" drawing (B size) sheets for binding or folding for insertion into the 8-1/2" X 11" (A size) report format.

D. Convey the project information in the simple format illustrated below. For a description of the required Title Block Contents see Table 202-2.

E. These drawings do not have to follow strict LANL Drafting Manual requirements for discipline separation, sheet type separation, or sheet identification format per Section 211. The only requirements are to follow:

Line type, line weights, font size and style, and standard symbols per this manual.

F. The following is an example of the Title Block format for the Studies and Reports (for a description of contents see Table 202-2).

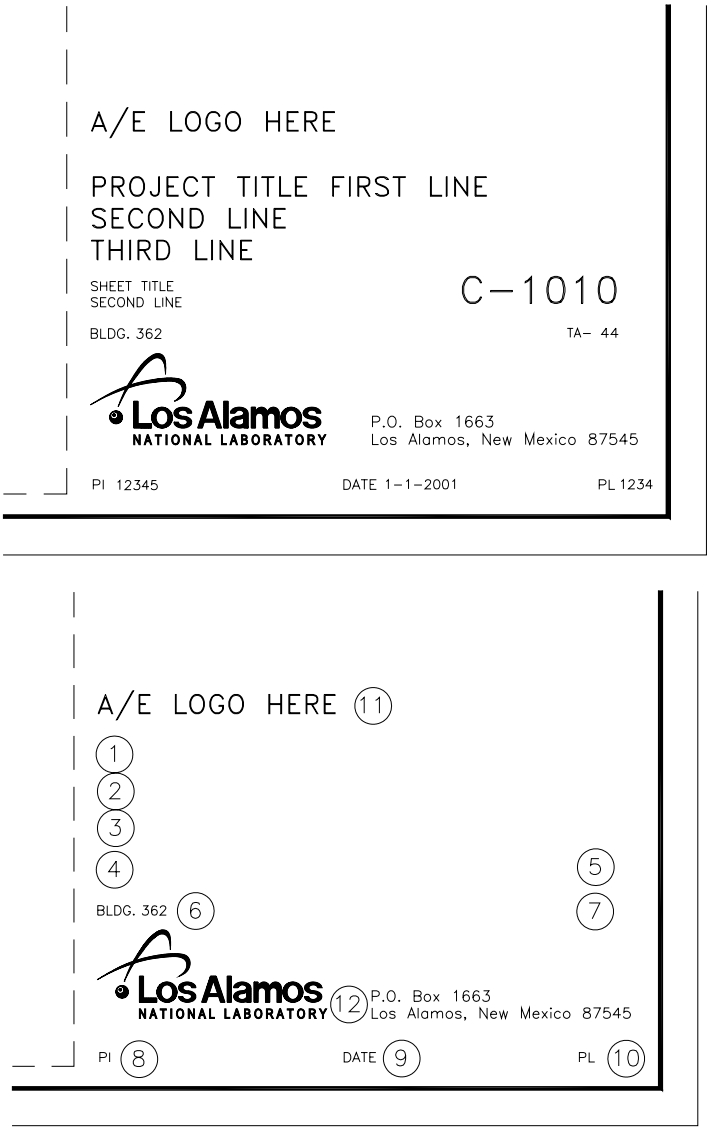


Figure 202-4

TABLE 202-2
Engineering Study, Design Criteria and Conceptual Design Report
Title Block Contents [3]

Item	Description	Character/ Size Font	Notes	Data Definition
1	Project Title	1/8” romand	1	A descriptive name of the project. Project Title and Title Sheet required for new facility construction. Not required for modifications to existing facilities.
2	Project Title Line 2	1/8” romand	1	Space for continuation of the Project Title.
3	Project Title Line 3	1/8” romand	1	Space for continuation of the Project Title.
4	Sheet Title	3/32” romand	1	A descriptive title of the information contained on the drawing sheet. There are two lines for the sheet title. First line is generally the type of drawing (e.g., Process and Instrumentation Diagram), second line generally the specific information (e.g., Compressed Air System).
5	Discipline Sheet Number	3/16” romand		Alphanumeric character, sequentially numbered, by discipline through the project drawing set.
6	Building Number	1/16” romans		The unique identifying number for a building or structure within a designated technical area.
7	Technical Area	1/8” romans		The geographical area designation assigned to LANL properties.
8	Project Identification Number	1/8” romans		A unique number assigned to a task by the CMMS.
9	Date	1/8” romans		The date the drawing set is issued for review or as final. Use the same date for all sheets in the drawing set.
10	Plate Number or Sketch Number	1/8” romans		A unique plate number (PL#) / sketch number (SK#) assigned by FWO DCRM Team Office.
11	Drawing Originating Organization	no requirement		The logo/name of the organization or firm doing the design.
12	LANL logo	1/8”		

Note: Do not underline titles or subtitles.

[3] Basis: LANL requirement for title blocks.

203 TITLE SHEET

4.0 GENERAL REQUIREMENTS

A. Provide a Title Sheet for drawings regardless of the number of drawing sheets in the drawing set.

B. *Guidance: Title sheets are not required but recommended for Engineering Studies, Design Criteria, and Conceptual Design Reports.*

5.0 EXAMPLE OF TITLE SHEET

A. The following graphic is an example of the Title Sheet for new projects (see Table 203-1 for content description). This Title Sheet (Appendix H) is found on the worldwide web site http://www.lanl.gov/f6stds/pubf6stds/drftman/appendix.htm

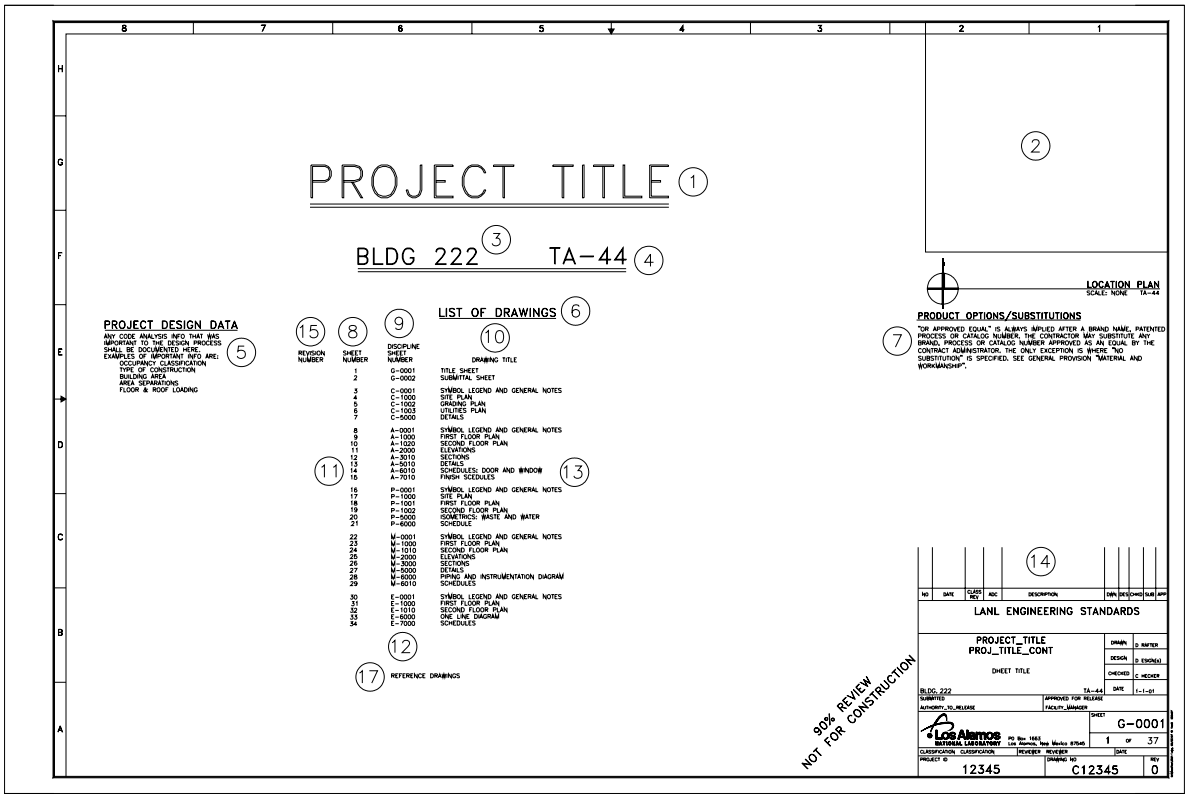


Figure 203-1

TABLE 203-1
Title Sheet Contents

Item	Description	Character/ Size Font	Data Definition
1	Project Title	1 inch, Romand, double underline 0.50 mm line width, color 1, continuous	The descriptive name of the project. Project title and title sheet required for new facility construction. Not required for modifications to existing facilities.
2	Location Plan	No scale	A plan that illustrates the location of the project - see Figure 203-1.
3	Building Number	1/2 inch, Romand, double underline 0.50 mm line width, color 1, continuous	The unique identifying number for a building or structure within a designated technical area.
4	Technical Area	1/2 inch, Romand, double underline	The geographical area designation assigned to LANL properties.
5	Project Design Data	1/8 inch Romand	This information is required (if not covered in specifications) - usually pertinent code analysis information is inserted here. Reference the code used and date of the code. (See Engineering Standards Manual, Chapter 4 - Architectural, Project Design Data.)
6	List of Drawings	1/4 inch Romand, single underline 0.50 mm line width, color 1, continuous	The header for the Drawing List.
7	Product Options and Substitution Statement	1/8 inch, Romand	A brief LANL procurement policy statement - see subpart 4.0 herein.
8	Sheet Number	1/8 inch Romand	The column header for the list of drawings sheet numbers.
9	Discipline Sheet Number	1/8 inch Romand	The column header for the list of drawings discipline sheet numbers.
10	Drawing Title/Header	1/8 inch Romand	List of the drawing sheet titles - show exactly as they appear in the title blocks of the drawing sheets.
11	Sheet Number	1/8 inch Romans	The number shown in the title block of each drawing sheet.
12	Discipline Sheet Number	1/8 inch Romans	The number shown in the title block of each discipline drawing sheet.
13	Drawing Titles	1/8 inch Romans	List of drawing sheet titles - show exactly as they appear in the title blocks of the drawing sheets.
14	Title Block	-	See Section 202.
15	Revision Column	1/8 inch Romand	The column header for the list of revisions that affect the drawing sheets.
16	Date Stamp	3/32” Romans	This stamp will assist in drawing file management, locating projects and data.
17	Reference Drawings	3/16 Romand	See definition in section 101.D

Note: All entries on the title sheet will be on layer: text, color: white, 0.35 mm pen width (0.015”).

6.0 LOCATION PLAN

A Location Plan is an area map that graphically illustrates the general location, by technical area, where the construction is planned.

A. All drawing sets are required to have a Location Plan.

B. Locate this plan on the Title Sheet in the upper right hand corner of the sheet (Fig. 203-1), as illustrated in Figure 203-2. The plan and all text shall not cover more than a 7.5" x 7.5" square.

C. Show enough of the surrounding areas (streets, buildings, structures, etc.) to clearly identify the project location.

D. Orient the Location Plan on the drawing sheet so that the north arrow points to the top of the sheet, as illustrated below.

E. An electronic or hard copy Location Plan can be obtained from the FWO-DCRM Team or the Support Services Subcontractor UMAP program for various Technical Areas within the LANL boundary.

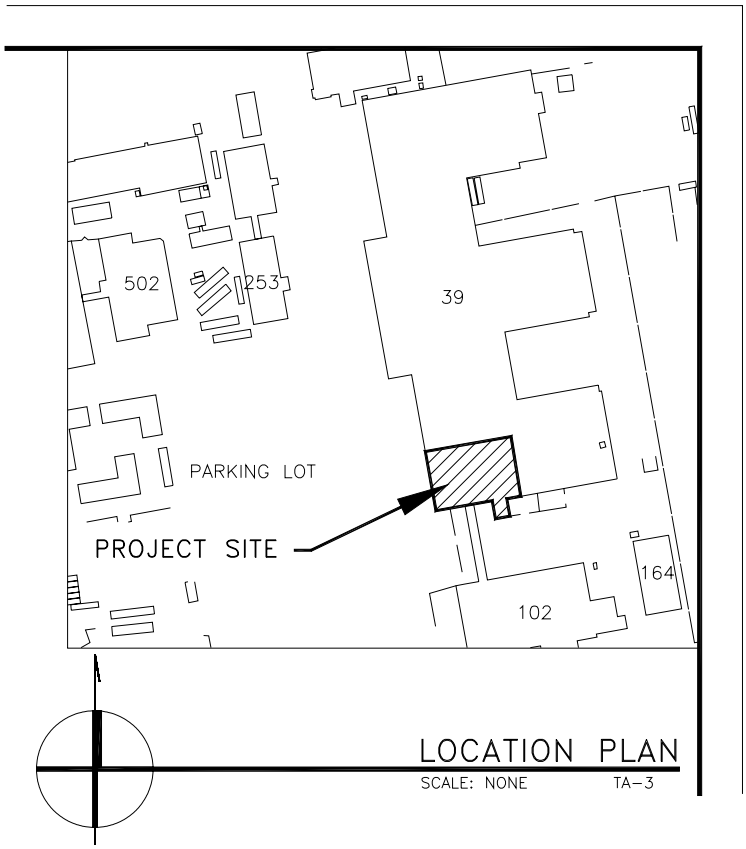


Figure 203-2

F. The borderline around the location plan shall be 0.50 mm line width.

G. Text requirements:

Project Site	3/16 inch romand
Location Plan	1/4 inch romand
TA	1/8 inch romans
All on Color: 7	Layer: G-ANNO

7.0 PRODUCT OPTIONS AND SUBSTITUTIONS

Note: This block is used only if a specific manufacturer's product is listed in the drawing package.

1. Enter the substitution statement exactly as stated in Section 01630 of the LANL Construction Specifications, layer: text.
2. The following is the wording from Section 01630 as of July 2001:

PRODUCT OPTIONS AND SUBSTITUTIONS
(3/16" text height, romand)

"Or approved equal" is always implied after a brand name, patented process or catalog number. The contractor may substitute any brand or process approved as an equal by specifying Architect/Engineer.
The only exception is where "no substitution" is specified.
See General Provision "Material and Workmanship."
(1/8" text height, romans)

3. For location of this block see Section 203, subpart 2.0, Example of Title Sheet.
4. Per LANL Construction Specifications Manual, Section 202.4, "Do not put specifications on drawings".

204 PLAN ORIENTATION

1.0 GENERAL

A. Except for Civil Plan and Section (profile) drawings, comply with the following for plan orientation on drawing sheets. *Guidance: Whenever possible orient the site plan in the same manner as the floor plan.*

1. Place the principal plans on the drawing sheet with the building lines parallel to the sheet borders.
2. Orient all principal plans in the drawing set identically for continuity and clarity.

3. Orient the plans on the drawing sheet so that the north arrow (true and plan north) are pointing in the direction of either the upper left or upper right quadrants of the sheet.

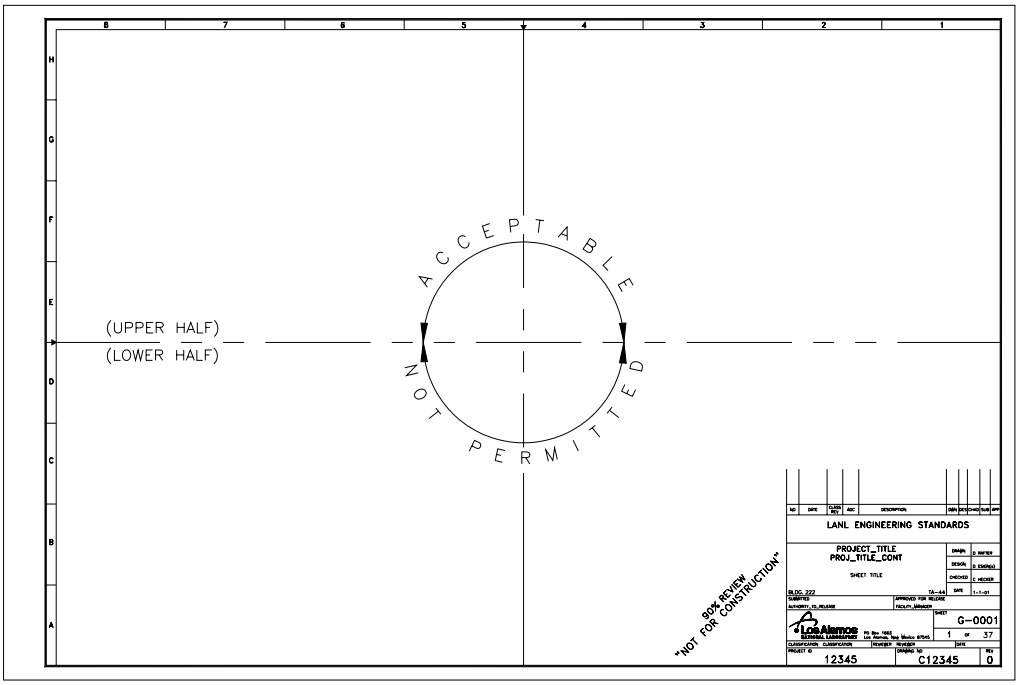


Figure 204-1

205 NORTH ARROW SYMBOL

1.0 EXAMPLES OF NORTH ARROW[4]

The graphic below is the required North Arrow showing “Plan North” and “True North”, Appendix B - G01, General Graphic Symbols.

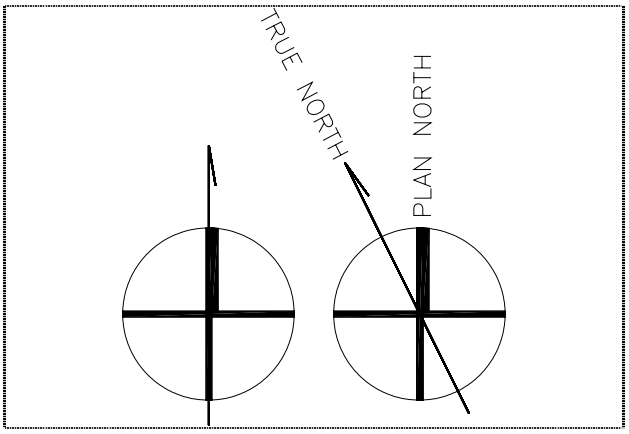


Figure 205-1

[4] Basis: National CAD Standards.

2.0 GENERAL REQUIREMENTS FOR NORTH ARROW

A. Placement of the North Arrow symbol is at the left end of the horizontal line under the title.

B. For “C,” “D,” and “E” size sheets make the circle 5/8 inches in diameter. For “A” and “B” size sheets make the circle 5/16 inches.

Figure 205-2

206 PARTIAL PLANS

1.0 KEY PLANS

A. Use a small scale "key plan" for each drawing sheet on which a partial plan appears.

B. Clearly indicate on the "key plan" where the partial plan occurs in the overall building layout.

C. Orient partial plans and key plans identically.

D. Locate the “key plan” in the upper right hand corner of the sheet and occupy a space no larger than a 5” x 5” square including all text.

E. Enlarged plans are considered partial plans if the enlarge plan only depicts a portion of the completed floor plan.

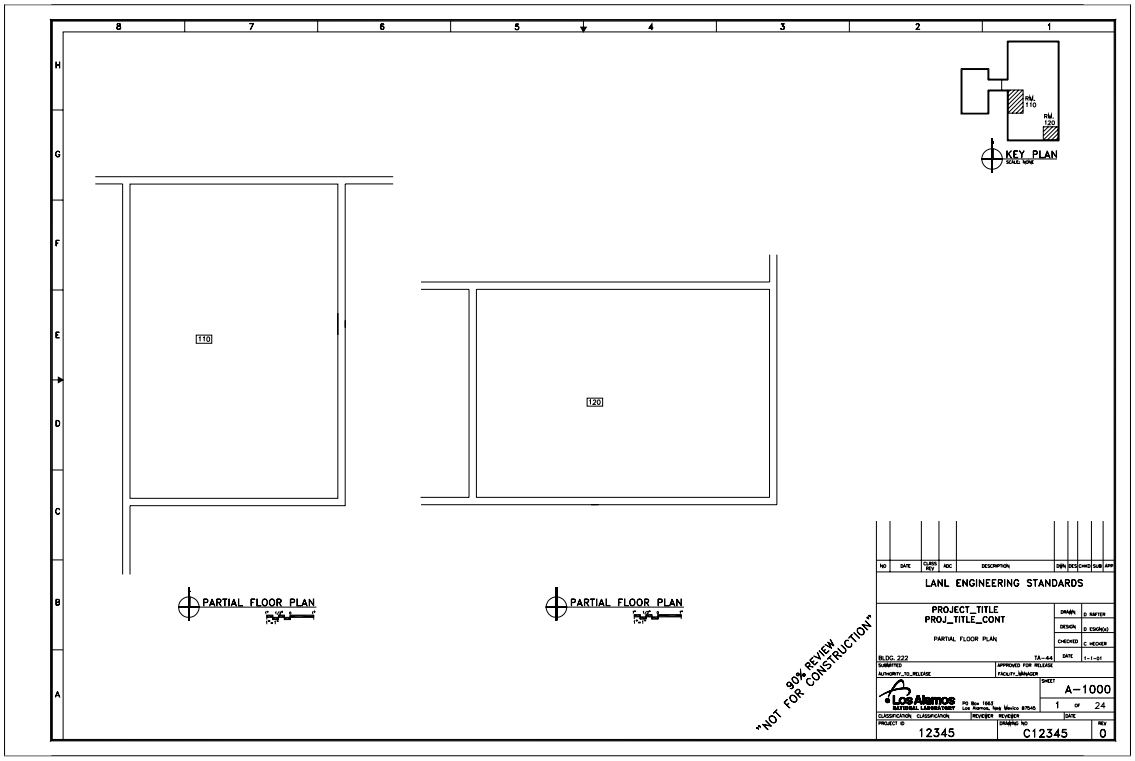


Figure 206-1

2.0 MATCH LINES

A. When a plan is too large for one drawing sheet, divide the plan into logical sections.

B. Provide a match line that is 0.80 mm (0.031”) thick, center line type.

C. Use a 1/4” text height, romand font, 0.50 mm line width to clearly indicate where the plan continues on another sheet, as illustrated below.

D. Use a key plan (see Figure 206-1 above).

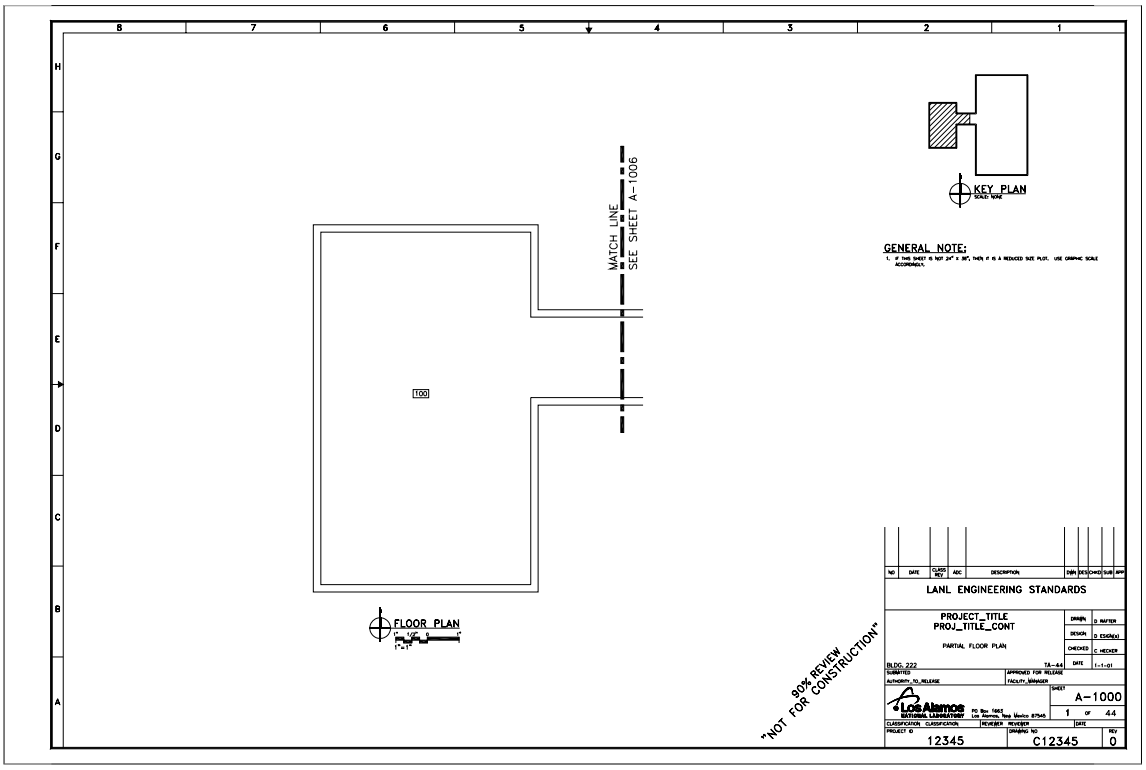


Figure 206-2

207 SUBMITTAL SHEET

1.0 CRITERIA AND GUIDELINES FOR SUBMITTAL SHEET

It is strongly recommended that LANL Construction Specifications section 01330, Submittal Procedures, be used. In all contract packages alternatively include a submittal sheet (General Information "G" Sheet) in the drawing set when submittals are required but when a specification package is not included with the construction documents. Use the following guidelines in producing the submittal sheet and stating the submittal requirements:

A. Produce a Submittal Schedule and Definition of Submittal Types on the "G" sheet (See Figure 207-1).

B. Do not place submittal lists on any of the discipline sheets.

2.0 NUMBERING THE REQUIRED SUBMITTALS

A. Assign each submittal an alphanumeric designation using no more than 3 characters. This alphanumeric designation is the "SUB NO." in the submittal schedule illustrated on the following page.

B. An alphanumeric designation represents the discipline requiring the submittal. Assign an alpha character representing the discipline using Section 210, Drawing Set Organization, as a guideline.

C. Assign a sequential number designation to the submittal by discipline.

3.0 SUBMITTAL SCHEDULE

The schedule is a General Symbols block (G44), found in Appendix B of this manual and LANL Construction Specifications, Section 01330.

Example of Submittal Sheet

SUBMITTAL SCHEDULE

P = REQUIRED WITH PROPOSAL; SUBMIT ONE COPY OF SUBMITTALS INDICATED TO THE ARCHITECT–ENGINEER IN ACCORDANCE WITH THE SUBMITTAL SCHEDULE.

A = REQUIRED AFTER RECEIPT OF ORDER; SUBMIT SIX COPIES OF SUBMITTALS INDICATED TO THE ARCHITECT–ENGINEER IN ACCORDANCE WITH THE SUBMITTAL SCHEDULE.

GENERAL: MARK SUBMITTALS WITH SUBMITTAL NUMBER AND TYPES (HIGHLIGHTED) TO SHOW MODEL NUMBERS, CAPACITIES, OPTIONAL FEATURES, ETC.

SUB NO.	DESCRIPTION	DRAWING NO. ITEM NO.	SUBMITTAL TYPES															REMARKS
			CONSTRUCTION										CLOSEOUT					
			CA	CD	CT	II	ML	PD	SC	SD	TR	WD	OM	RD	SP	WA		
			CALCULATIONS	CATALOG DATA	CERTIFICATIONS	INSTALLATION INSTRUCTIONS	MATERIALS/PARTS LIST/ DESIGN MIXES	PERFORMANCE DATA/CURVES	SAMPLES/COLORS	SHOP DRAWINGS	TEST REPORTS	WIRING DIAGRAMS	OPERATION AND MAINTENANCE DATA	PROJECT RECORD DOCUMENTS	SPARE PARTS AND MAINTENENCE MATERIALS	WARRANTIES		SUBMIT CONSTRUCTION SUBMITTALS WITHIN 30 DAYS AFTER START OF CONSTRUCTION. SUBMIT CLOSEOUT SUBMITTALS WITHIN 30 DAYS AFTER FINAL INSPECTION.
G1	CONSTRUCTION DWG'S.	ALL SHEETS												A				
C1	SUMP PIT	C05001				P												
A1	OVERHEAD	A–7007				P												
M1	PUMP	M–7011		A				A										
E1	ALARMS	E–7009				P												

DEFINITIONS OF SUBMITTAL TYPES

CA. CALCULATIONS

THE METHODS AND RESULTS OF CALCULATIONS IN DOCUMENTED FORM WHERE SPECIFIED.

CD. CATALOG DATA

STANDARD PRINTED INFORMATION ON MATERIALS, PRODUCTS, AND SYSTEMS, WHICH SHOWS PERFORMANCE CHARACTERISTICS, DIMENSIONS, MATERIAL OF FABRICATION, AND OTHER CHARACTERISTICS NECESSARY TO ASSURE CONFORMITY WITH THE DESIGN REQUIREMENTS. WHERE OTHER ITEMS OR INFORMATION NOT RELATED TO THE WORK OF THIS PROJECT ARE INCLUDED IN THE LITERATURE SUBMITTED, THE ITEM(S) AND/OR INFORMATION APPLICABLE TO THIS PROJECT SHALL BE CLEARLY MARKED.

CT. CERTIFICATIONS

A WRITTEN STATEMENT, SIGNED BY A QUALIFIED PARTY, ATTESTING THAT ITEMS OR SERVICES ARE IN ACCORDANCE WITH SPECIFIED REQUIREMENTS. TYPICALLY, THIS WRITTEN STATEMENT IS ACCOMPANIED BY ADDITIONAL INFORMATION TO SUBSTANTIATE THE STATEMENT.

II. INSTALLATION INSTRUCTIONS

MANUFACTURER'S INSTRUCTIONS, STEP–BY–STEP IF NECESSARY, SHOWING THE FIELD INSTALLATION OF PARTS, COMPONENTS, EQUIPMENT AND OTHER SIMILAR ITEMS.

ML. MATERIAL LIST/PARTS LIST/DESIGN MIXES

A LIST OF SYSTEM COMPONENTS OR MATERIAL COMPONENTS.

PD. PERFORMANCE CURVES/DATA

PERFORMANCE CURVES AND/OR DATA FOR THE SELECTED EQUIPMENT TO SHOW COMPLIANCE WITH CONTRACT DOCUMENTS.

SC. SAMPLES/COLORS

SAMPLES, INCLUDING COLORS OF PROPOSED MATERIALS.

SD. SHOP DRAWINGS

DRAWINGS NECESSARY TO SHOW FABRICATION DETAILS TO ENSURE COMPLIANCE WITH CONTRACT DOCUMENTS.

TR. TEST REPORTS

RESULTS OF SPECIFIED TEST REQUIREMENTS.

WD. WIRING DIAGRAMS

DRAWINGS SHOWING THE POINT–TO–POINT WIRING OF A PIECE OF EQUIPMENT OR BETWEEN PIECES OF EQUIPMENT IN A SYSTEM.

OM, SP. & WA O&M MANUALS/SPARE PARTS LIST/WARRANTIES

MAINTENANCE SUBMITALS SHALL INCLUDE BOTH MAINTENANCE AND OPERATING MANUALS. INCLUDE EMERGENCY INSTRUCTIONS, SPARE PARTS LISTINGS, WARRANTIES, WIRING DIAGRAMS, RECOMMENDED "TURN–AROUND" CYCLES, INSPECTION PROCEDURES, SHOP DRAWINGS, PRODUCT DATA, AND SIMILAR INFORMATION AS APPLICABLE.

RD. PROJECT RECORD DOCUMENTS

AS–BUILT DRAWINGS: A SET OF RED LINED PRINTS NOTING ALL DEVIATIONS FROM THE CONSTRUCTION DRAWINGS.

Figure 207-1

208 DRAWING SCALES AND TOLERANCES

1.0 GRAPHIC SCALES

A. When drawings are produced to scale, insert graphic scales illustrating the drawing scale. Use these formats for standard graphic scales: (Refer to Appendix B)

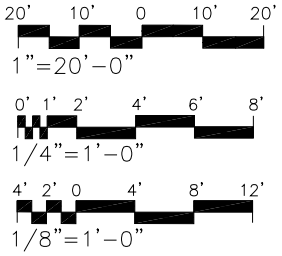


Figure 208-1

B. In the illustration above, 3/32" text (the minimum allowable) is shown for the distance designations for all graphic scales because of the limited space available. The drawing scale designation text is shown at 1/8". These text heights were selected for graphic clarity. Graphic scales are to be right justified[5] and 1/4" below the drawing title, see Figure 206-1 and 206-2 for examples.

C. Include the following statement as a General Note on the drawing sheet:

> "If this sheet is not (state the original plot size, i.e., 24" x 36"), then it is a reduced size plot. Use graphic scale accordingly."

2.0 DRAWING SCALES

A. Acceptable drawing scales and the call out protocol for drawings are as follows:

Item	Scale	Item	Scale
Contour, Grading, Landscaping, Site, Utility, Plans:	1" = 10' 1" = 20' 1" = 30' 1" = 40' 1" = 50' 1: = 60' * 1" = 100' 1" = 200' 1" = 500' 1" = 1000'	Plan & Profiles: Horizontal Scale: Vertical Scale: Sections:	 1" = 10'; 1" = 20" 1" = 5'; 1" = 10' 1/8" = 1'-0" 1/4" = 1'-0" 1/2" = 1'-0" 3/4" = 1'-0" 1" = 1'-0"

*** Note:** New Mexico plot size (LANL design basis)

(Continued on next page)

[5] Per National CAD Standards

Item	Scale	Item	Scale
Floor Plans and Elevations:	1/16” = 1’-0” 1/8” = 1’-0” 1/4” = 1’-0”	Partial/Enlarged Plans:	1/4” = 1’-0” 1/2” = 1’-0” 3/4” = 1’-0”
Details:	1/2” = 1’-0” 3/4” = 1’-0” 1” = 1’-0” 1 1/2” = 1’-0” 3” = 1’-0”		

Basis: National CAD Standards

B. If a graphic scale is used then the use of “SCALE”: x” = x’-0” is not required under title. If “SCALE: NONE” is used under title, then the graphic scale is not required.

3.0 CONSISTENCY OF DRAWING SCALES

Draw all principal plans in a drawing set at the same scale, line type and line width.

4.0 EQUIPMENT ROOM DRAWING SCALES

A. Layout all equipment, piping, conduits, trays, ducts, wiring, etc., located within the equipment rooms on an enlarged partial floor plan shown at 1/4" = 1' - 0" scale minimum.

B. In rooms, areas, and spaces that are designed to accommodate equipment, show the equipment layout in detail plans, interior elevations and sections, as required for clarity.

C. Use enlarged sections and details to show congested areas at minimum scale of 1/2" = 1' - 0" for clarity.

5.0 NO SCALE DRAWINGS

Certain details, diagrams, and plans cannot or need not be drawn to a specific scale (i.e., wiring, P&IDs, schematics, and control diagrams). For the drawing scale notation type "SCALE: NONE" indicating that no scale was used in generating the drawing.

Figure 208-2

6.0 TOLERANCES

Guidance: Tolerances should be noted per ANSI Y14.5 - 1994, "Dimensioning and Tolerancing for Engineering Drawings (inches)," and client design criteria.

209 DIMENSIONING & LEADERS

1.0 GENERAL

A. Specify dimensions of less than one foot in inches, for example:

11 1/2"

B. Specify dimensions one foot and over in feet and inches, for example:

2' - 6 1/4"

C. Exception to these rules occurs when dimensioning civil drawings, mechanical ductwork and piping, electrical control cabinets and boxes, or architectural woodwork.

D. Do not stack fractions.

2.0 DIMENSION LINE CONVENTION AND TEXT ORIENTATION

A. Use unbroken dimension lines with the dimension text located above the line. All dimension text must be read from the bottom or right side of the drawing sheet.

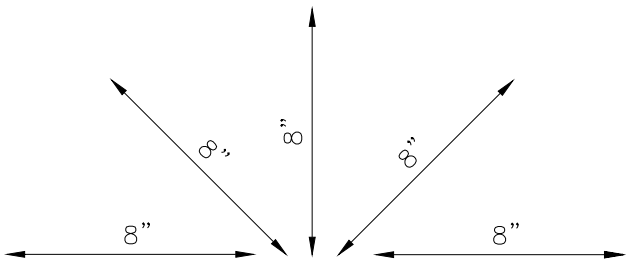


Figure 209-1

B. *Guidance: For examples of text orientation for isometric drawings refer to Global Engineering Documents, current edition, Section 3 and 4; DOE Handbook 1016, or AIA Architectural Graphic Standards.*

3.0 DIMENSION LINE TERMINATION

A. Arrowheads, slashes, and dots are all acceptable terminators for dimension lines.

B. Draw a heavy terminator (arrowhead 1/8" in length, 45 degrees diagonal, 0.80 mm line width tic mark, or 1/16" diameter solid circle) to ensure readability when reproduced or reduced to half size. Use a consistent terminator throughout all drawing sheets for a discipline in a drawing set. AutoCAD setting for terminator to be 1/8 inch. Text shall be 1/8" romans, color-white. Arrows and dimension line shall be color 9.

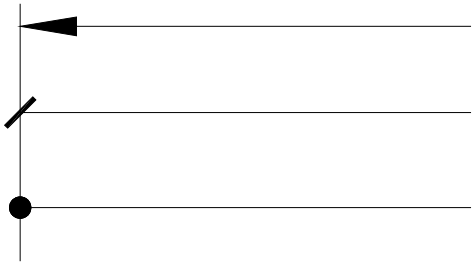


Figure 209-2

C. "Tic" marks shall be used in the architectural discipline.

D. Do not mix termination symbols within a discipline.

4.0 PLAN DIMENSIONS

A. *Keep dimension lines clear of the building footprint whenever possible.*

B. *Place dimension lines in a logical progression (i.e., centerlines, projections, overall, etc.).*

C. *Keep the dimensions consistent on all plans.*

D. *Tie all building portions together clearly.*

E. *Do not dimension to hidden features.*

F. *Refer to the National CAD Standards Manual Drafting Conventions, current edition, for hierarchy of dimensioning.*

5.0 DIMENSIONS NOT TO SCALE

A. When dimensional changes are made on drawings that affect the dimensions shown on a detail, it is not necessary to change the detail to agree with the new dimension. Change the dimension text to match the new dimension and note "NTS" below the dimension line, to indicate "Not to Scale" as illustrated below.

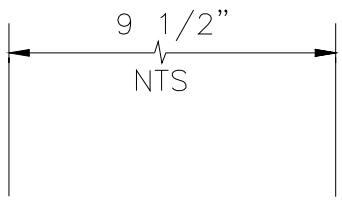


Figure 209-3

6.0 LEADERS

A. All leaders with single text notations shall start from the leader terminator (arrow) and end 1/16” from the text notation. See Figure 1.

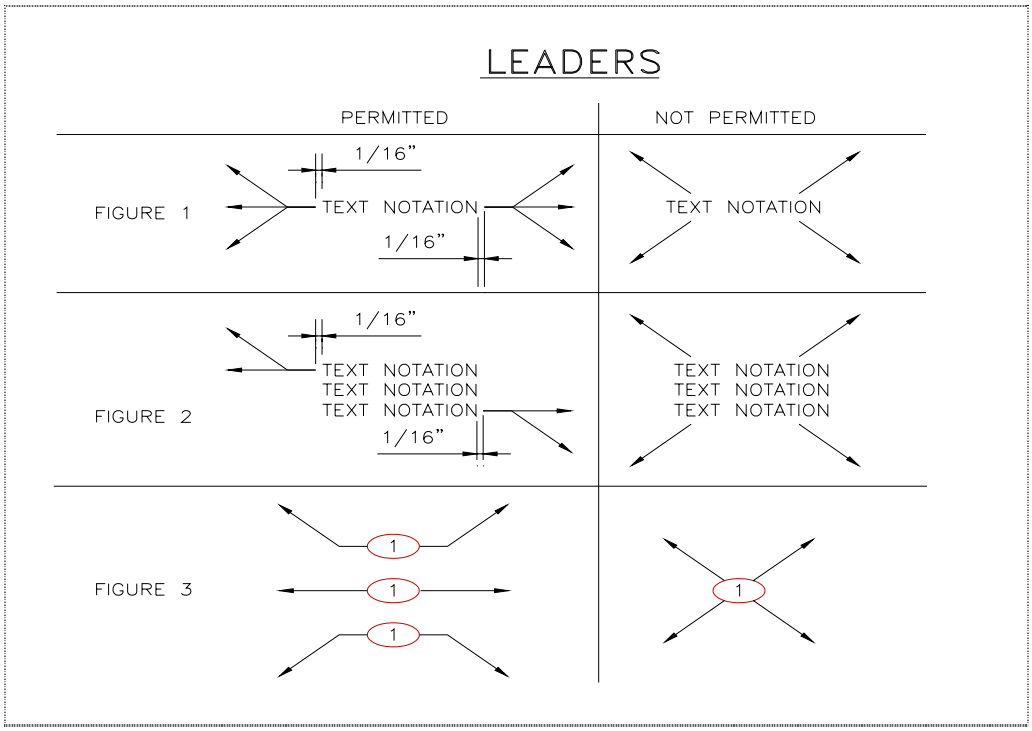
B. All leaders with multiple text notations shall start from the leader terminator (arrow) and end 1/16” from the text notation. Hence: upper left corner or lower right corner of the note. See Figure 2.

C. Leaders for use with Keyed Notes shall start from the leader terminator (arrow) and end/attach at the edge of the Keyed Note Bubble. See Figure 3.

D. Crossing of leaders is not allowed.

E. Leader terminator is a 1/8” arrow when plotted 1:1 on a “D” size drawing.

F. Use a 1/8” dot for a leader terminator to indicate a surface point on a “D” size drawing when plotted 1:1.



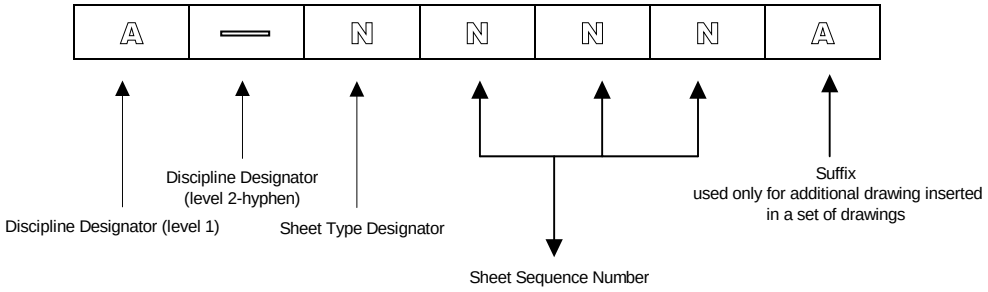
Arrow length = 1/8”
Arrow color = Lt. Gray (9)

Figure 209-4

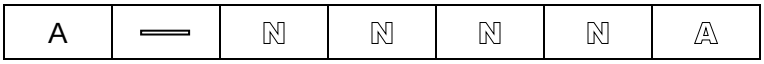
210 DRAWING SET ORGANIZATION

1.0 STANDARD SHEET IDENTIFICATION (NUMBERING)

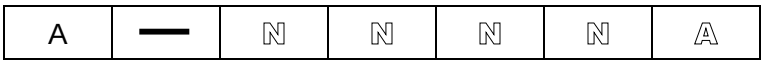
A. The required sheet identification format is applicable to all construction drawing production (Title I and Title II) (This does not include ES or CDRs). It is consistent, yet flexible enough for a wide range of project scopes. The Uniform Drawing System (UDS) by the Construction Specifications Institute (CSI) sheet identification format depicted here has three components:



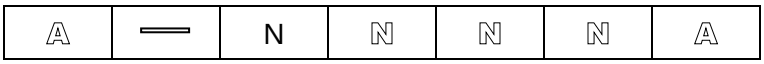
LEVEL 1: Discipline designator, consisting of 1 alphabetical character,



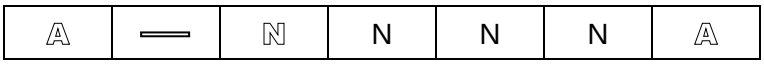
LEVEL 2: Discipline designator, is not used, replace with a hyphen,



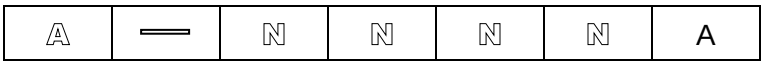
B. The **Sheet Type Designator,** identifies the type of information on the sheet and is followed by the **Sheet Sequence number**. **Sheet Type designator,** consisting of 1 numerical character,



Sheet Sequence number, consisting of 3 numerical characters.



Supplemental Drawing Sheet



C. The one-character **Discipline designator** identifies the sheet as a member of a subset.

1. Within the discipline designator, the first character is the discipline character. The discipline character identifies the creator of the drawings on the sheet.

2.0 LEVEL 1 - DISCIPLINE DESIGNATOR

A. The first component of the sheet identification format, the discipline designator, is based on the traditional system of alphabetical discipline designators.

B. Organize the drawing sets by discipline in the following order (as applicable):

Order Sequence	Discipline Code	Discipline
1	G	General (Title Sheet, General Notes, Scope of Work, Submittals)
2	H	[1] Hazardous Materials
3	V	Survey/Mapping
4	B	Geotechnical
5	W	[1] Civil Works (User Defined)
6	C	Civil
7	L	[1] Landscape
8	S	Structural
9	A	Architectural
10	I	Interiors
11	Q	Equipment (laboratory, food service parking lot, site)
12	F	Fire Protection
13	P	Plumbing
14	D	[2] Process (e.g., gloveboxes and process piping to and from gloveboxes), fumehoods and process equipment
15	M	Mechanical
16	E	Electrical
17	T	Telecommunications
18	R	[1] Resources
19	X	Other Disciplines (i.e., Safeguards & Security)
20	Z	[1] Contractor/Shop Drawings
21	O	Operations

[1] Uniform Drawing System (UDS) discipline code not used at LANL.

[2] UDS discipline code modified for LANL application.

3.0 SHEET TYPE DESIGNATOR

A. The second component of the sheet identification format is the sheet type designator. The sheet type is identified by a single numerical character. All sheet types may not apply to all discipline designators. It is not necessary to use all the sheet types for a project or within a discipline.

B. Organize the Sheet Types in the following order (as applicable):

TABLE 210-1

0	**General** (symbols legend, notes, etc.)
1	**Plans** (horizontal views including civil plans & profiles)
2	**Elevations** (vertical views)
3	**Sections** (sectional views)
4	**Large Scale views** (plans, elevations, or sections that are not details)
5	**Details**
6	**Diagrams**
7	**Schedules**
8	**User Defined** (for types which do not fall in other categories)
9	**3D Representations** (isometrics, perspectives, models, and photographs)

4.0 SHEET SEQUENCE NUMBER

A. The third component of the sheet identification format is a three-digit sheet sequence number that identifies each sheet in a series of the same discipline and sheet type. The first sheet of each series is number **000**, followed by **001** through **999**. (A three (3) - digit sequence number is required for efficient electronic file sorting and facility management databases.)

A	—	N	N	N	N	A

B. On plan sheets, it may be desirable to replicate the floor name within each discipline. This makes sheets **A-1002, M-1002,** and **E-1002** the second floor plan for each of the various disciplines. This system may become cumbersome when basements and mezzanines or split level plans are involved. Evaluate each project carefully before deciding to implement this option.

C. Additional drawings inserted in a set of drawings after a sheet identification organization has already been established can be identified with a suffix. *This suffix may be comprised of a defined designator; starting with the letter "A."*

211 ARRANGEMENT AND NUMBERING SEQUENCE

1.0 DRAWING SETS

A. Shall be arranged in a defined order and assigned a unique number, within each discipline, as specified in Table 211-1. These sheet sequence numbers must be unique not only within the drawing set, but also unique with respect to ALL other drawings for each structure. For example, if an E-6000 already exists for a particular structure, then the next drawing set created must either revise this pre-existing E-6000 or begin its sheet sequence at E-6001. A list showing what drawings already exist and which sheet sequence numbers have already been used can be obtained from FWO-IBS DCRM team (667-4696) or search "Facility Custom Reports" on-line at http://arania.lanl.gov/fwo_pub/fwo_iim/data/html/moads.html. Crypto authentication required).

Note: Drawing sets will not always include all of the types of drawings listed below, and show the commonly used disciplines:

TABLE 211-1

Discipline	Numbering Sequence	Order of Drawings
(G) General	0001 - 0999	General (Title Sheet, Legend, General Notes; Scope of Work, Construction Sequence, Project Specifications (3), and Orientation Maps)
(V) Survey / Mapping	0001 - 0999	General (Design Criteria Information, Legend, General Notes; Scope of Work, and Construction Sequence)
	1000 - 1999	Plans, (Demolition dwgs first, followed by New Construction), Boundary, Contour, Archaeological, and historical features
	2000 - 2999	Elevations
	3000- 3999	Sections
	4000 - 4999	Large Scale Views (Plans, Elevations, or Sections that are not details)
	5000 - 5999	Details
	6000 - 6999	Diagrams
	7000 - 7999	Schedules
	8000 - 8999	User Defined
	9000 - 9999	3D Representation (isometrics, perspectives, photographs)

Discipline	Numbering Sequence	Order of Drawings
(B) Geotechnical	0001 - 0999	General (Design Criteria Information, Legend, General Notes; Scope of Work, and Construction Sequence)
	1000 - 1999	Plans Demolition dwgs first, followed by New Construction
	2000 - 2999	Elevations
	3000 - 3999	Sections
	4000 - 4999	Large Scale Views (Plans, Elevations, or Sections that are not details)
	5000 - 5999	Details
	6000 - 6999	Diagrams
	7000 - 7999	Schedules
	8000 - 8999	User Defined
	9000 - 9999	3D Representation (isometrics, perspectives, photographs)
(C) Civil	0001 - 0999	General (Design Criteria Information, Legend, General Notes; Scope of Work, and Construction Sequence)
	1000 - 1999	Plans (Demolition dwgs first, followed by New Construction, Site, Grading, Utility, Soil Boring logs, Plan & Profile,)
	2000 - 2999	Elevations
	3000 - 3999	Sections
	4000 - 4999	Large Scale Views (Plans, Elevations, or Sections/Cross Sections that are not details)
	5000 - 5999	Details
	6000 - 6999	Diagrams
	7000 - 7999	Schedules
	8000 - 8999	User Defined
	9000 - 9999	3D Representation (isometrics, perspectives, photographs)
(S) Structural	0001 - 0999	General (Design Criteria Information, Legend, General Notes; Scope of Work, and Construction Sequence)
	1000 - 1999	Plans (Demolition dwgs first, followed by New Construction)
	2000 - 2999	Elevations
	3000 - 3999	Sections
	4000 - 4999	Large Scale Views (Plans, Elevations, or Sections that are not details)
	5000 - 5999	Details
	6000 - 6999	Diagrams
	7000 - 7999	Schedules
	8000 - 8999	User Defined
	9000 - 9999	3D Representation (isometrics, perspectives, photographs)

Discipline	Numbering Sequence	Order of Drawings
(A) Architectural	0001 - 0999	General (Design Criteria Information, Legend, General Notes; Scope of Work, and Construction Sequence)
	1000 - 1049	Reserved for Record Floor Plans
	1050 - 1999	Plans (Demolition dwgs first, followed by New Construction)
	2000 - 2999	Elevations
	3000 - 3999	Sections
	4000 - 4999	Large Scale Views
	5000 - 5999	Details
	6000 - 6999	Diagrams
	7000 - 7999	Schedules
	8000 - 8999	User Defined
	9000 - 9999	3D Representation (isometrics, perspectives, photographs)
(I) Interiors	0001 - 0999	General (Design Criteria Information, Legend, General Notes; Scope of Work, and Construction Sequence)
	1000 - 1999	Plans (Demolition dwgs first, followed by New Construction)
	2000 - 2999	Elevations
	3000 - 3999	Sections
	4000 - 4999	Large Scale Views (Plans, Elevations, or Sections that are not details)
	5000 - 5999	Details
	6000 - 6999	Diagrams
	7000 - 7999	Schedules
	8000 - 8999	User Defined
	9000 - 9999	3D Representation (isometrics, perspectives, photographs)
(Q) Equipment	0001 - 0999	General (Design Criteria Information, Legend, General Notes; Scope of Work and Construction Sequence)
	1000 - 1999	Plans (Demolition dwgs first, followed by New Construction)
	2000 - 2999	Elevations
	3000 - 3999	Sections
	4000 - 4999	Large Scale Views
	5000 - 5999	Details
	6000 - 6999	Diagrams
	7000 - 7999	Schedules
	8000- 8999	User Defined
	9000 - 9999	3D Representation (isometrics, perspectives, photographs)

Discipline	Numbering Sequence	Order of Drawings
(F) Fire Protection	0001 - 0999	General (Design Criteria Information, Legend, General Notes; Scope of Work and Construction Sequence)
	1000 - 1999	Plans (Demolition dwgs first, followed by New Construction)
	2000 - 2999	Elevations
	3000 - 3999	Sections
	4000 - 4999	Large Scale Views
	5000 - 5999	Details
	6000 - 6999	Diagrams
	7000 - 7999	Schedules,
	8000 - 8999	User Defined
	9000 - 9999	3D Representation (isometrics, perspectives, photographs)
(P) Plumbing [1]	0001 - 0999	General (Design Criteria Information, Legend, General Notes; Scope of Work and Construction Sequence)
	1000 - 1999	Plans (Demolition dwgs first, followed by New Construction)
	2000 - 2999	Elevations
	3000 - 3999	Sections
	4000 - 4999	Large Scale Views
	5000 - 5999	Details
	6000 - 6999	Diagrams
	7000 - 7999	Schedules and Lists
	8000 - 8999	User Defined
	9000 - 9999	3D Representation (isometrics, perspectives, photographs)
(D) Process	0001 - 0999	General (Design Criteria Information, Legend, General Notes; Scope of Work and Construction Sequence)
	1000 - 1999	Plans (Demolition dwgs first, followed by New Construction)
	2000 - 2999	Elevations
	3000 - 3999	Sections
	4000 - 4999	Large Scale Views
	5000 - 5999	Details
	6000 - 6999	Diagrams (Process Flow, Piping & Instrumentation for process systems, gloveboxes and fume hoods)
	7000 - 7999	Schedules, Lists
	8000 - 8999	User Defined
	9000 - 9999	3D Representation (isometrics, perspectives, photographs, risers)

Discipline	Numbering Sequence	Order of Drawings
(M) Mechanical [2]	0001 - 0999	General (Design Criteria Information, Legend, General Notes; Submittals, Scope of Work Construction Sequence, Schedules)
	1000 - 1999	Plans (Demolition dwgs first, followed by New Construction)
	2000 - 2999	Elevations
	3000 - 3999	Sections
	4000 - 4999	Large Scale Views
	5000 - 5999	Details
	6000 - 6999	Diagrams (PFDs, P&IDs, Logic)
	7000 - 7999	Schedules, Lists
	8000 - 8999	User Defined
	9000 - 9999	3D Representation (isometrics, perspectives, photographs)
(E) Electrical	0001 - 0999	General (Design Criteria Information, Legend, General Notes; Scope of Work and Construction Sequence)
	1000 - 1999	Plans (Demolition dwgs first, followed by New Construction) (floor, equipment, power, lighting, grounding, lightning, emergency, special systems)
	2000 - 2999	Elevations
	3000 - 3999	Sections
	4000 - 4999	Large Scale Views
	5000 - 5999	Details
	6000 - 6999	Diagrams (one-lines, ladder grounding lightning wiring, logic, schematics (control systems i.e.: PLC cabinet), Riser - Fire Alarm Public Address Communication Security.
	7000 - 7999	Schedules (Bill of Material, Nameplate, etc.)
	8000 - 8999	User Defined
	9000 - 9999	3D Representation (isometrics, perspectives, photographs)
(T) Tele-communication	0001 - 0999	General (Design Criteria Information, Legend, General Notes; Scope of Work and Construction Sequence)
	1000 - 1999	Plans (Demolition dwgs first, followed by New Construction)
	2000 - 2999	Elevations
	3000 - 3999	Sections
	4000 - 4999	Large Scale Views
	5000 - 5999	Details
	6000 - 6999	Diagrams
	7000 - 7999	Schedules
	8000 - 8999	User Defined
	9000 - 9999	3D Representation (isometrics, perspectives, photographs)

Discipline	Numbering Sequence	Order of Drawings
(O) Operations	0001 - 0999	General (Design Criteria Information, Legend, General Notes; Scope of Work and Construction Sequence [for construction by Support Services Subcontractor only], Schedules/Lists)
	1000 - 1999	Plans (Demolition dwgs first, followed by New Construction)
	2000 - 2999	Elevations
	3000 - 3999	Sections
	4000 - 4999	Large Scale Views
	5000 - 5999	Details
	6000 - 6999	Diagrams
	7000 - 7999	Schedules
	8000 - 8999	User Defined
	9000 - 9999	3D Representation (isometrics, perspectives, photographs)
(R) Other Disciplines (i.e., Security & Safeguards)	0001 - 0999	General (Design Criteria Information, Legend, General Notes; Scope of Work and Construction Sequence)
	1000 - 1999	Plans (Demolition dwgs first, followed by New Construction)
	2000 - 2999	Elevations
	3000 - 3999	Sections
	4000 - 4999	Large Scale Views
	5000 - 5999	Details
	6000 - 6999	Diagrams
	7000 - 7999	Schedules
	8000 - 8999	User Defined
	9000 - 9999	3D Representation (isometrics, perspectives, photographs)

[1.] Drainage (for plumbing systems see Section 307 of this manual).

[2.] Air conditioning, ventilation, cooling, heating, refrigeration, fuel oil, compressed air, laboratory gas steam and condensate systems.

[3.] Refer to ESM Chapter 1, Section Z10 for specification requirements.

2.0 PRIORITY DRAWINGS

A. *Guidance: Priority Drawings typically consist of piping and instrument diagrams (P&IDs), flow diagrams, and electrical one-line diagrams helpful to the safe operation and shutdown of a facility. Other types of drawings such as architectural drawings, mechanical prints, floor plans, piping schedules, or databases may be included if facility requirements dictate.*

B. The importance of the system and its documents (e.g., drawings) shall be determined by the Facility Manager for new and existing facilities in regards to control of nuclear and non-nuclear hazards, the safety of the public, environment, worker (i.e., hazard class, hazard category, etc.), and the facility mission (LIR240-01-01, Configuration Management).

C. A priority drawing shall have the words "PRIORITY DRAWING" stamped in black or electronically inserted on the sheet, 1/4" text height, layer "PRIORITY," color white, Romand font. The words shall appear just above the title block space allocated for revisions. Refer to the ESM Chapter 6, Mechanical P&ID example drawings.

D. For revising priority drawings follow LANL AP-ENG-002, *Developing and Revising a Design Change Package* or AP-ENG-003, *Developing and Revising an Engineering Change Notice* for appropriate application.

212 LINE WORK

1.0 BASIC LINE WIDTHS, AND SCREENING

A. Requirement:

1. Use a heavy line width to indicate new construction for a given discipline.
2. Use a medium line width for text and to delineate new construction above or below the drawing plane.
3. Use a light line width to delineate existing construction or new background base plans, and for dimension lines, leader lines and extension lines.

B. Contrast the three line widths definitively as illustrated below:

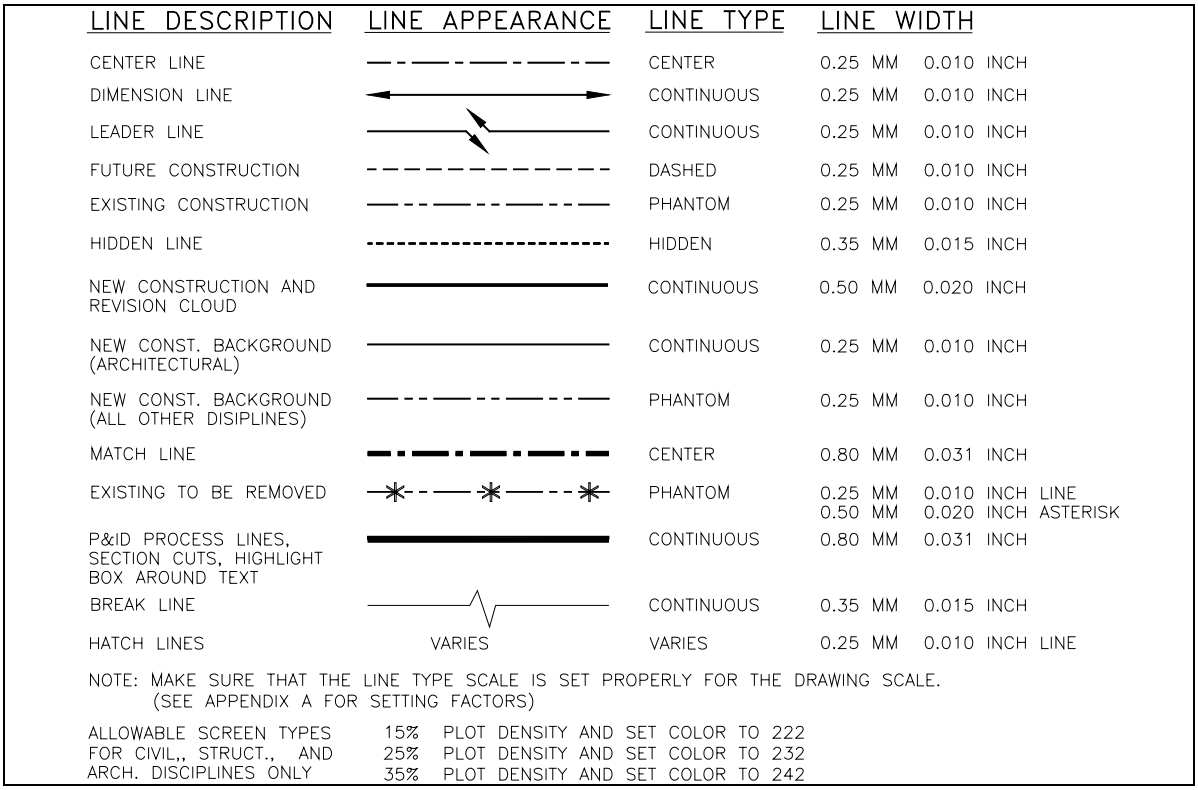


Figure 212-1

Note: Make sure that the LT scale is set properly for the drawing scale. (See Appendix A for setting factors.) Screening 15, 25, and 35%.

2.0 LINE WIDTH ASSIGNMENT IN ELECTRONIC FILES

A. Assign lines a width by creating the line or entity in an appropriate layer. Each layer is assigned a color for the desired line width of entities created in that layer. As indicated in the table below, colors 1 through 15 are the extent of the allowable color range for LANL projects.

	Color Number	Line Width in mm	Line Width in Inches
Red	1	0.50	0.020
Yellow	2	0.50	0.020
Green	3	0.50	0.020
Cyan	4	0.50	0.020
Dark Blue	5	0.35	0.015
Magenta	6	0.35	0.015
White	7	0.35	0.015

	Color Number	Line Width in mm	Line Width in Inches
Dark Gray	8	0.35	0.015
Light Gray	9	0.25	0.010
Red	10	0.25	0.010
Mauve	11	0.25	0.010
Dark Red/Brown	12	0.25	0.010
Light Red/Brown	13	0.80	0.024
12	14	0.80	0.031
Brown	15	0.50	0.010

Note: Some LANL groups and projects may require or prefer color reproductions; the color yellow is not legible and should not be used in these cases.

213 STANDARDIZATION OF TEXT

1.0 FONT STYLES AND TEXT SIZE REQUIREMENTS

A. Use only standard AutoCAD fonts: Romans and Romand. Do not use stylized fonts or fonts not standard to AutoCAD.

B. Fonts other than Romans and Romand can be used on the title sheet (Section 203) for the Design Agency logos. If a logo contains a font that is not standard to AutoCAD, convert the logo to a drawing or change the logo to an electronic format that can be read by the standard AutoCAD package.

C. Match the existing font style and height for uniformity of presentation when revising existing drawings.

D. The minimum text height in the drawing field on C and D size sheets is 1/8 inch.

E. The minimum text height in the drawing field on A and B size sheets is 3/32 inch.

F. The minimum text height only applies in circumstances when another convention is not specified in this document.

2.0 TEXT FORMATTING CONVENTIONS

A. Create all text in upper case letters, with the exception of certain unit designations such as kVA, mm, kHz, Vac, Vdc, mA, which are recognized as an industry standard.

B. Use text that is legible when reduced to one-half size on half-size drawing sets.

C. Leave a minimum space of one-half the text height between text lines and special marks to maintain legibility.

D. Maintain standard text conventions across disciplines in a drawing set.

E. Orient text to read horizontally from left to right and/or vertically from the bottom to the top of the sheet.

F. Font width factor shall be a "1" unless otherwise specified in this manual.

G. When inserting text into a D or E size drawing comply with the following:

TEXT FOR	EXAMPLE	LINE WIDTH	FONT
MAIN TITLE	ABCDEFG RSTU 1/4" WXYZ 1/4"	0.35 MM 0.015 INCH	ROMAND
SUB TITLE	ABCDEFG RSTU 3/16" WXYZ 3/16"	0.35 MM 0.015 INCH	ROMAND
ALL TITLE BLOCK TEXT	(SEE SECTION 202 FOR CHARACTER SIZE)	0.35 MM 0.015 INCH	SEE SECT. 202 FOR FONT
ALL OTHER TEXT	MINIMUM TEXT SIZE ABCDEFG VWXYZ 1/8" ABCDEFG VWXYZ 1/8"	.035 MM 0.015 INCH	ROMANS

NOTE: UNLESS OTHERWISE SPECIFIED FOR NON-CONSTRUCTION PROJECTS

Figure 213.1

Note: The "Sub Title" designation referred to in the table above is most commonly used in schedules. The schedule title is the main title (1/4" Romand) and the column headers for the schedule are the sub titles (3/16" Romand).

H. When using paper space and model space on drawings, and after setting the scale of view port, lock the view port to prevent the moving of the model space in the View port in paper space. Do **not** use password protection when locking view ports.

I. Be consistent throughout the design drawing package in using model space/paper space when using text and dimensions.

214 SECTIONS, ELEVATIONS, DETAILS, AND CALLOUTS

1.0 GENERAL

A. Identify sections, elevations, and details by referencing them with symbols or callouts.

B. Font width for sheet numbers in detail, elevation, and section bubbles shall be 0.75.

C. Do not duplicate letter or numbers on either the Sections or Detail sheets.

D. Start lettering or numbering sequence at the Upper Left Corner and finish at the Lower Right Corner of drawing.

E. Do not explode blocks generated for sections, elevations, and/or details.

2.0 REFERENCE DESIGNATIONS

A. Identify sections and elevations by **LETTERS**, and details by **NUMBERS**. Reference sections, elevations and details with the discipline sheet number, for example: A1000, C-1000, S-1000, …

3.0 PROTOCOL FOR REFERENCES AND CALLOUTS

A. On the sheet where details, sections or elevations are drawn, number or letter them independently by sheet, as opposed to consecutively by discipline or project. Order the numbers and letters sequentially in each drawing sheet that contains elevations, details or sections. Begin with the number 1 for details, and the letter "A" for the elevation or section designation. Start at the upper left corner of the sheet and finish at the lower right corner, working from let to right-like reading a page in a book.

B. When a detail or section is eliminated, the deleted detail or section number or letter may be reused or left blank. The details or sections do not have to be renumbered as the result of a deletion.

4.0 EXAMPLES OF PROTOCOLS

A. A section, detail or elevation drawn on the same sheet with a plan or collectively is not permitted. (Exception: see Section 100, 3,0D-Definitions and 4.0-Sketches)

B. A detail, section or elevation **not** drawn on the sheet it is referenced or cut (see figure 214-1):

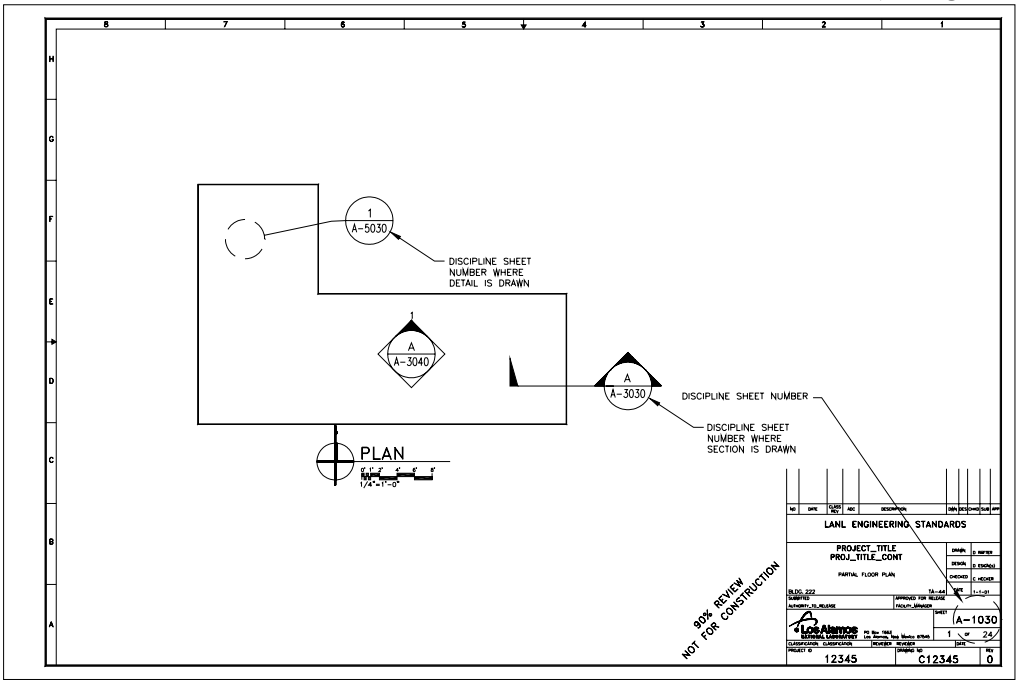


Figure 214-1

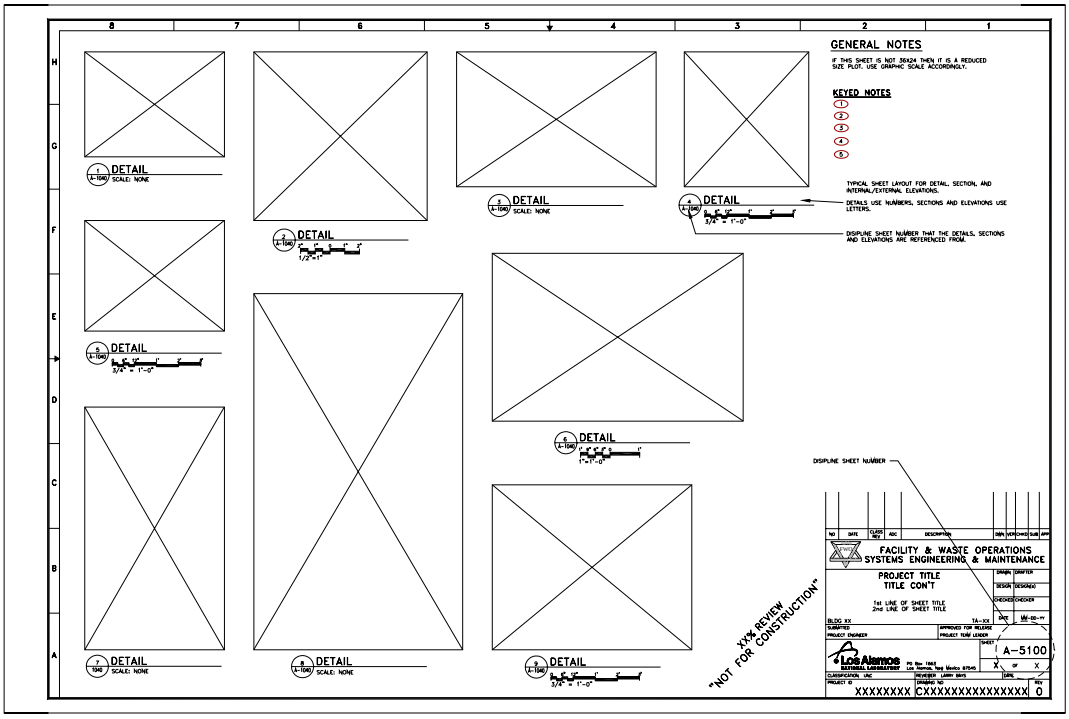


Figure 214-2

5.0 SECTION SYMBOLS

A. Standard Section Symbol:

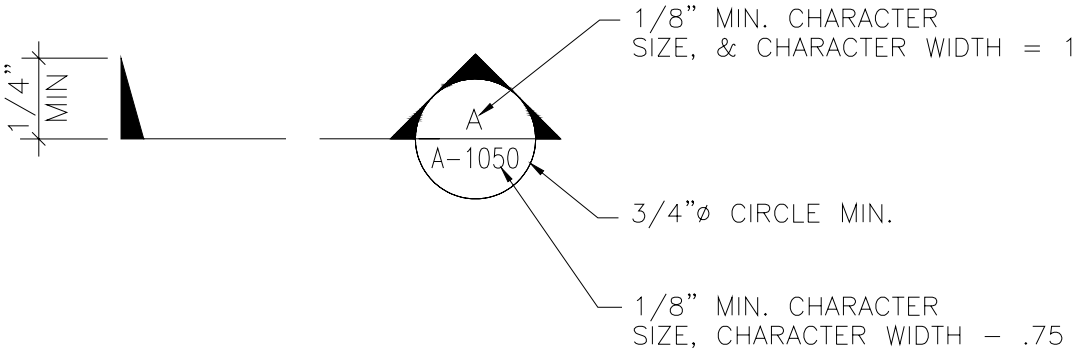


Figure 214-3

B. Acceptable Section Symbols when space for referencing is severely restricted:

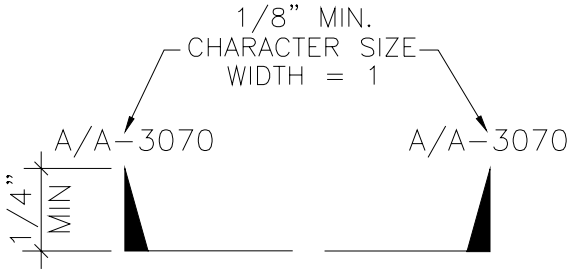


Figure 214-4

C. Detail Symbol

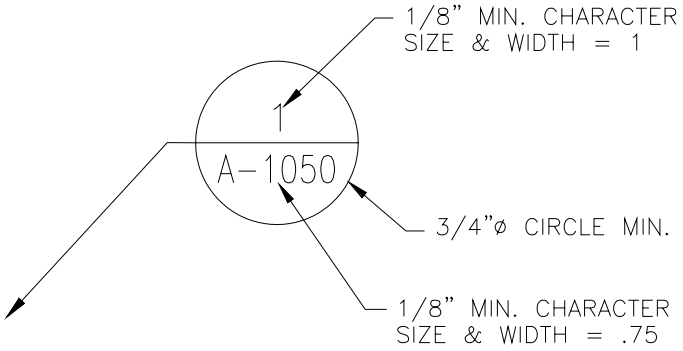


Figure 214-5

D. Detail Projection Element Method:

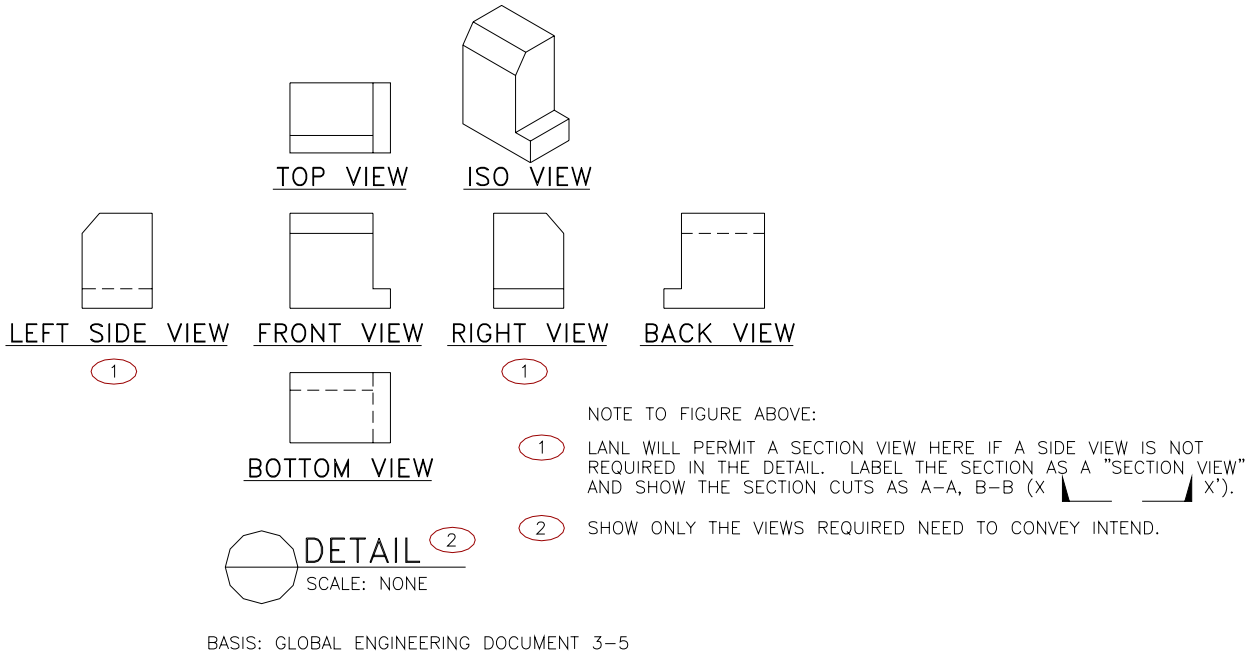


Figure 214-5A

6.0 SECTION, ELEVATION, AND DETAIL TITLES

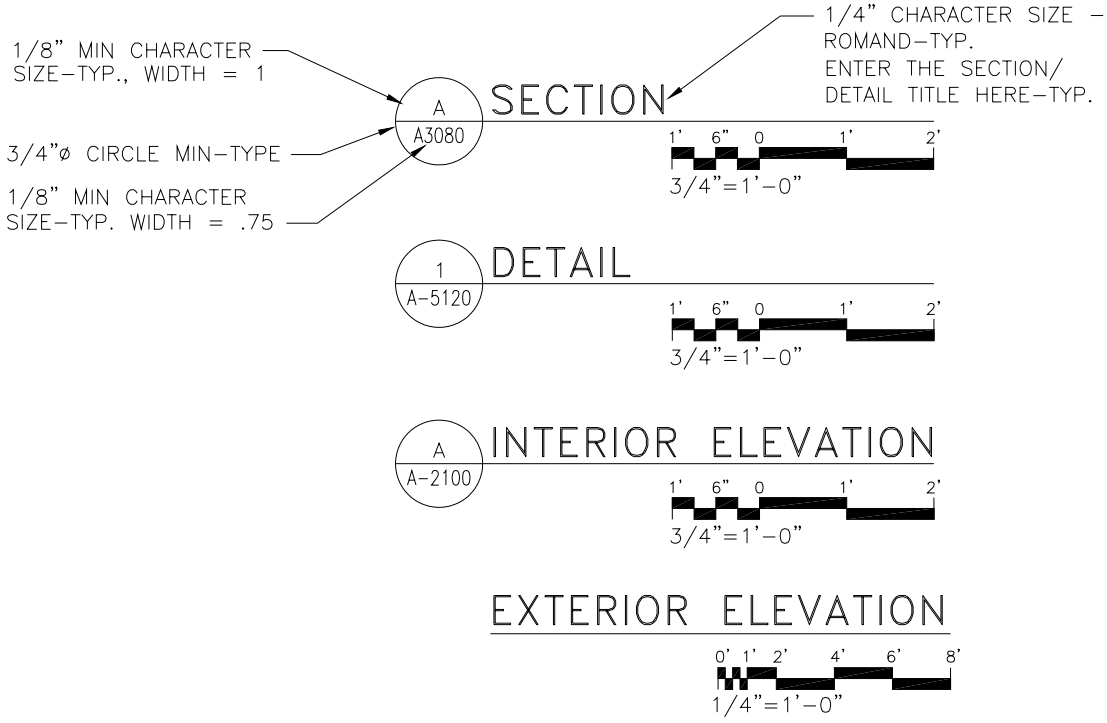


Figure 214-6

7.0 INTERIOR ELEVATIONS SYMBOL

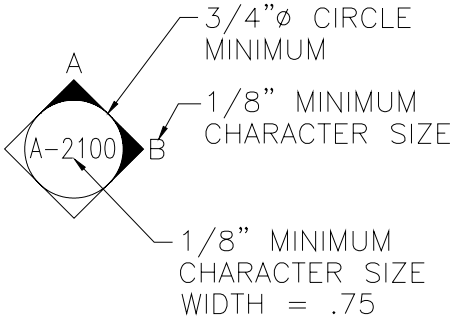


Figure 214-7

8.0 EXTERIOR ELEVATIONS

A. Reference exterior elevations by the plan direction (i.e., North, South, East, and West).

9.0 KEYED NOTES

A. Use keyed notes where space is limited in the drawing field. Keyed Notes shall be located below General Notes as shown in Figure 202.1.

B. Number keyed notes independently by sheet, as opposed to consecutively by discipline or project.

C. Begin numbering keyed notes on each sheet that contains keyed notes with the number one. Number each note sequentially in ascending order.

D. If a keyed note is deleted, insert the comment "not used" in place of the deleted note or re-use the number for another note. It is not necessary to re-number keyed notes because of a deletion.

E. When a keyed note is used, show the keyed note legend on the same sheet where reference is made. See Figure 202-1 for location of the Keyed Note legend.

F. Do not use keyed notes for dimensions, air flows (CFMs), or under any other circumstances that are inappropriate.

G. The keyed note symbol is an oval with a number designation. The standards established for text apply to the numeric character in the keyed note bubble. See Figure 214-8 for an example of the Keyed Note style. General Symbol G-46 and G-47 (Appendix B) establishes keyed note bubble size and “Keyed Notes” legend header.

H. The following is the example of the format for the keyed note legend.

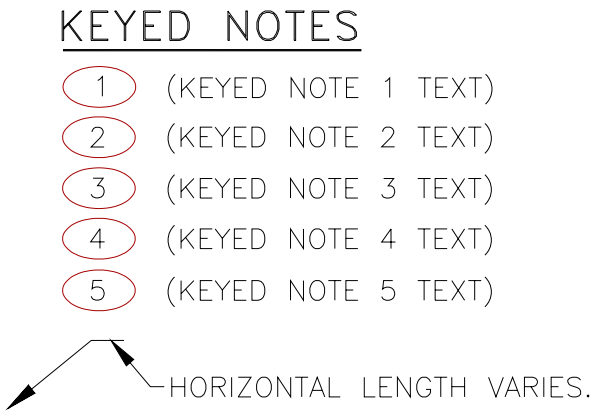


Figure 214-8

10.0 GENERAL NOTES [6]

A. When a General Note is used, show the general notes on the same sheet where reference is made.

B. The General Notes legend shall be located above the "keyed note" legend as shown in Figure 202-1. Add plot size note. See Section 208.1C.

C. The General Notes legend header shall be the same as the keyed note header established in General Symbol file number G-46 of Appendix B.

D. General Note headers should be 3/16" Romand.

E. The following is the example of the format for the general note legend:

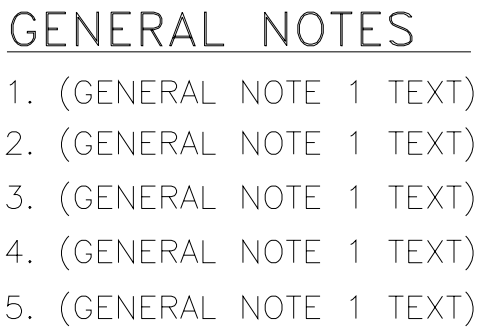


Figure 214-9

[6] Basis: National CAD Standards.

215 ELECTRONIC CAD FILE CONVENTIONS

1.0 ELECTRONIC FILE NAMING CONVENTION

A. Each drawing file will be named accordingly:

- Project Identification (PI#) or Drawing # followed by the sheet identification number:

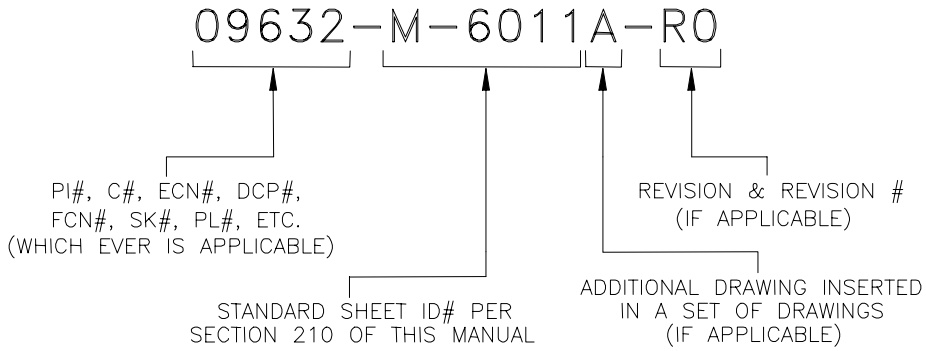


Figure 215-1

2.0 CAD LAYERING GUIDELINES

2.1 Maximum Number of Layers

A. Fifty (50) is the preferred maximum for the number of layers in a drawing file. In extreme cases, it is acceptable to increase the number of layers to a maximum of 100.

2.2 Layer Naming Convention

A. Use the US National CAD Standard Version 2 (or later) AIA CAD Layer Guidelines for establishing layer names for all drawings. The only exceptions to those guidelines are:

1. The addition of a “G” (for general) group in the major groups. The “G” major group is added for general information that is not discipline specific, such as Title Blocks, Title Sheets, Submittal, and General Notes sheets and Symbols that are applicable to all disciplines.
2. Do not exceed 16 characters in assigning any layer name. This allows for the addition of extra characters that are added to the layer name automatically when X-Refs are used and eventually bound to the file.

3.0 ELECTRONIC FILE FORMAT FOR FINAL DELIVERABLES

A. One complete set of electronic files shall be placed on CD(s) and sent to FWO DCRM Team Records Center with a transmittal letter itemizing the contents and confirmation that the project has been approved and completely signed off for construction and as-builts.

B. Affix a stick-on label to the CD with the following completed data:

- LANL Project ID#
- LANL Drawing # (C#) or ECN#, DCP#, FCN#, SK#, or PL#
- TA and Building
- Title of Project
- Number of electronic files submitted: X of X

C. CD's that contain classified information shall be identified as such per S-7 and/or ADC instructions. **Note: FWO DCRM Team does not handle classified documents**.

D. If another graphics software was used to create a drawing file, deliver the file in a format that can be recognized by and can be converted to AutoCAD (i.e.: ASCII format, DXF file).

E. It is preferred that only standard AutoCAD Release 2000 or higher options be used in creating drawing files. Third party software that is completely compatible and supportable by AutoCAD Release 2000 or higher is acceptable.

F. Not all contractors and subcontractors have AutoCAD release 2000 or above. All electronic files created in AutoCAD 2002 - 2004 shall be saved as AutoCAD 2000.

G. The deliverable media for electronic files are CD disks. The entire project file can be stored on one CD, provided it fits. Label the disk with the official **PROJECT NAME, LANL PROJECT ID, DRAWING NO.(s), STAGE/PHASE** (Title II, Engineering Study, etc), **DATE SUBMITTED, ACAD VERSION/WORD PROCESSING PROGRAM** used to create the documents, **DESCRIPTION OF DOCUMENTS** contained on the disk. It should also be noted if any third party add on software packages were used to augment the standard AutoCAD package.

H. A "read me" file is required if special instructions are needed for other users to understand the drawing files.

I. Bind all externally referenced (X-REF) drawing files using the X-REF Bind command sequence and lock all view ports with the Lock Command. Refer to the AutoCAD Users Guide for instructions on binding x-refs.

J. Identify the plotting scale on the drawing file as well as on the delivered media.

K. It is not necessary to identify the plotting scale if it is 1:1.

L. The preferred plotting scale is 1:1. If the scale is different than 1:1, then indicate the scale on the drawing file and the deliverable label.

- To minimize potting discrepancies for color; dithering; gray scale; pen assignments; screening; line-type; line weight; end styles; join styles; and fill styles, set the AutoCAD plot style to selection "2000-STD-Pens." Refer to the AutoCAD Users Guide, "Plotting Your Drawing" for assistance in setting this plotting style.
- Shading (if required) in a drawing shall be done by using the standard AutoCAD Hatch Patterns.

M. Final deliverables shall be "As-Built" documents with the conversion requirements implemented from Section 103, "As-Built Revision Procedures" of this manual.

N. "Purge" all unnecessary blocks, text styles, and layers on all drawings prior to electronic FWO-DCRM Team submittals. Refer to the AutoCAD Users Guide for the "purging" procedure.

216 FOLDING DRAWING PRINTS

1.0 PRINT FOLDS

A. *Guidance: Drawing sizes "B" through "E" and roll sizes are normally folded after printing to 8 1/2 x 11 inches to fit standard-size file folders and filing cabinets.*

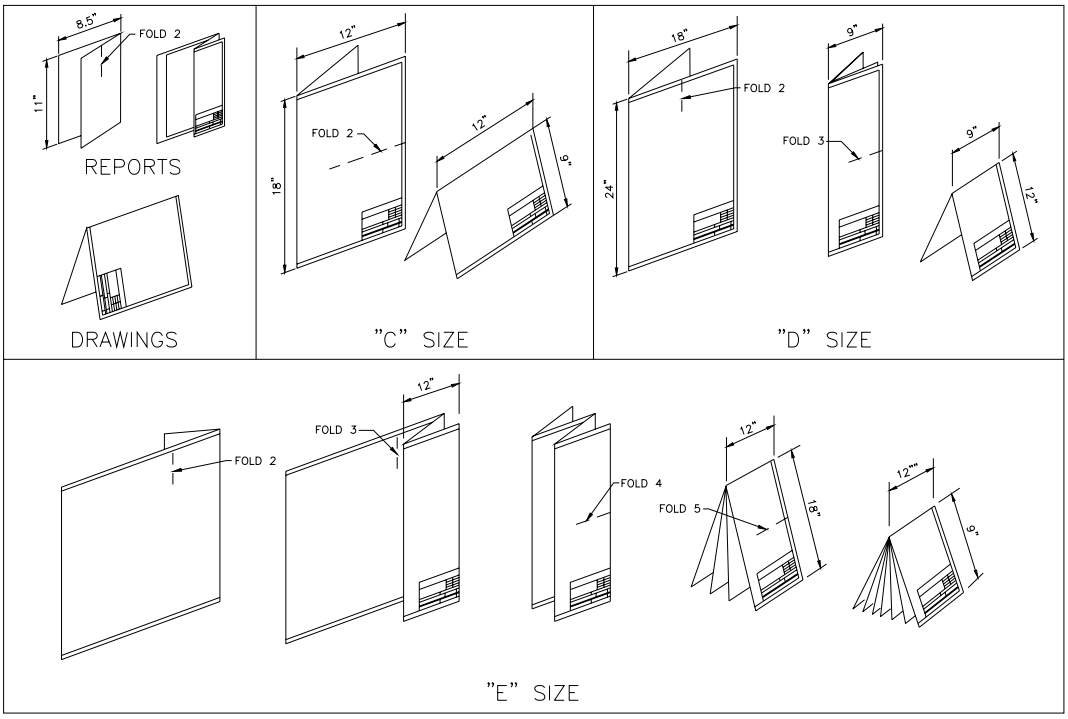


Figure 216-1, Global Engineering Documents (10th Edition)

ATTACHMENT 1 - FWO CONTACT INFORMATION

Request Type	Source	Contact	Main Phone Number
Project Identification No.	CMMS database *FWO-IIM Group*	CMMS Team	667-6068
Drawing no(s). (C#, PL#, etc.)	DCRM Team *FWO-IBS Group*	Document Control & Records Management	667-4696
Calculation no.	DCRM Team *FWO-IBS Group*	Document Control & Records Management	667-4696
SK no.	DCRM Team *FWO-IBS Group*	Document Control & Records Management	667-4696
DCP or ECN no. [IFMP-AP-ENG-002 & IFMP-AP-ENG-003]	DCRM Team *FWO-IBS Group*	Document Control & Records Management	667-4696
Drawing / construction project research	DCRM Team *FWO-IBS Group*	Document Control & Records Management	667-4696
Bldg. no.	Siting Committee *PM-1* Site & Project Planning *Group*	Planning Services	665-5900
Technical Design Reviews [IFMP-AP-ENG-017 & IFMP-AP-DCRM-003]	FWO-Design Engineering & Construction Group	Design Review Project Leader	Group Office 667-4657

AP	Administrative Procedure
C[#]	Construction [number]
Calc	Calculation
DCP	Design Change Package
DCRM	Document Control & Records Management
DECS	FWO-Design Engineering & Construction Services Group
ECN	Engineering Change Notice
FWO	Facility and Waste Operations Division
IBS	FWO-Integrated Business Systems Group
IIM	FWO-Integrated Information Management Group
LANL	Los Alamos National Laboratory
PI	Project Identification
SK	Sketch

Rev. 0, 9/2004